TECHNICAL FISHERY REPORT 93-14

Alaska Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 25526
Juneau, Alaska 99802-5526

September 1993

Stock Composition of Sockeye Salmon Catches in Southeast Alaska Districts 106 and 108 Gillnet Fisheries, 1989, Estimated with Scale Pattern Analysis

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State of Alaska Walter J. Hickel, Governor

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ACKNOWLEDGEMENTS

We are grateful to personnel of the Port Sampling Project of the Division of Commercial Fisheries, Alaska Department of Fish and Game (ADF&G) and to personnel of the Canadian Department of Fisheries and Oceans (DFO)for their assistance in gathering samples from catches and escapements. In particular, we would like to thank Cathy Robinson and Elizabeth Enge of ADF&G and Sandy Johnson and Peter Etherton of DFO for their coordination of sampling efforts. We gratefully acknowledge the efforts of Renate Riffe for aging scales, Scott McPherson for scale aging consultations, and Scott McPherson and Mindy Rowse for age composition analysis of the commercial catches.

PROJECT SPONSORSHIP

This investigation was financed with U.S./Canada Pacific Salmon Treaty funds, under Cooperative Agreement NA90AA-H-FM010

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ABSTRACT

Linear discriminant function analysis of scale patterns was used to estimate the 1989 sockeye salmon *Oncorhynchus nerka* stock compositions in the commercial gillnet fisheries in Southeast Alaskan Districts 106 and 108. Of 84,848 sockeye salmon harvested in Subdistrict 106-30, an estimated 66.1% were of Alaska origin, 32.2% of Nass/Skeena origin, and 6.1% of transboundary Stikine River origin. The Subdistrict 106-41 harvest of 107,886 fish was composed of an estimated 65.2% Alaska stocks, 30.3% Nass/Skeena stocks, and 4.5% of Stikine River stocks. An estimated 82.8% of the District 108 catch of 10,083 sockeye salmon was composed of Stikine River stocks, whereas the Alaska and Nass/Skeena stocks contributed 17.0% and 5.4%, respectively. The catch per unit effort for all stocks peaked in early to mid-July in both districts. The District 106 sockeye catch of 192,734 fish in 1989 was higher than average (1982–1988). The Alaska I stock group was relatively less abundant and the Nass/Skeena group more abundant than average for the same years. Inseason stock composition estimates were significantly different from postseason estimates. The contributions of the Alaska stocks were overestimated and the Nass/Skeena and Stikine River contributions were underestimated.

KEY WORDS: sockeye salmon, linear discriminant function analysis, stock composition, migratory timing, Stikine River

INTRODUCTION

Sockeye salmon *Oncorhynchus nerka* are harvested in marine net fisheries throughout Southeast Alaska and northern British Columbia. Drift gillnet fisheries in Alaskan commercial fishing Districts 106 and 108 harvest sockeye salmon of Alaskan origin but also catch sockeye salmon of transboundary Stikine River and of Canadian Nass and Skeena River origin. Interception of salmon originating in one country as the fish migrate through the territorial waters of the other country has become a research and management concern since the implementation of the U.S./Canada Pacific Salmon Treaty. Cooperative international management of Stikine River sockeye salmon is mandated by this treaty under Annex IV, Chapter 1. Knowledge and control of stock-specific harvests are therefore needed to fulfill requirements of and assess compliance with the harvest sharing guidelines outlined in the treaty.

Objectives

The purposes of this study are to (1) develop inseason estimates of the contributions of major sockeye stock groups to gillnet fisheries in Alaskan Subdistricts 106-30 and 106-41, and District 108 and (2) refine the stock composition estimates postseasonally with current-year escapement standards. This project has been conducted annually using scale pattern analysis (SPA) to provide inseason weekly stock composition estimates of the catches since 1985 and postseason estimates since 1982. Estimation of the interception rates and relative abundance of Stikine River sockeye stocks is requisite for managers from the Alaska Department of Fish and Game (ADF&G) and the Canadian Department of Fisheries and Oceans (DFO) to implement Treaty guidelines. Data from this study is needed for run reconstruction for Stikine River sockeye salmon and for forecasting the next year's run size.

Study Area

Sockeye salmon harvested in the District 106 and 108 commercial fisheries originate from lake systems and their tributaries throughout Southeast Alaska, from the transboundary Stikine River, and from the Canadian Nass and Skeena Rivers (Figure 1). Tagging studies have shown that few stocks from other areas pass through District 106 (Steve Hoffman et al. 1983, 1984). In those studies adult sockeye salmon were tagged in 1982 and 1983 in several Alaskan and Canadian fishing districts to determine migratory pathways and interception rates of various stocks. The majority of terminal area recoveries of fish tagged in District 106 occurred along the northeast coast of Prince of Wales Island and upper Behm Canal; some were recovered in Alaskan systems as far south as the U.S./Canada border and in the Stikine, Nass, and Skeena Rivers. There were few or no recoveries of fish tagged in District 101 or 104 in either the northern Prince of Wales Island lake systems or the Stikine River.

Numerous sockeye salmon producing lakes are scattered throughout the archipelago and mainland of Southeast Alaska. They range in size from small lakes of a few hectares to large systems greater than 500 hectares—e.g., McDonald and Klawock Lakes—and include multilake systems like the Sarkar andGalea-Sweetwater complexes (Figure 2). Sockeye salmon production is limited by the quantity and quality of spawning areas, the available rearing area, or other environmental conditions as well as the number of spawners. Sockeye productivity varies greatly, even among systems of roughly equivalent size (McGregor 1983; McGregor et al. 1984; McGregor and McPherson 1986; McPherson and McGregor 1986; McPherson, McGregor, and Bergander 1988; McPherson, McGregor, and Olsen 1988; Rowse and McPherson *in press*). Typical small systems, such as Alecks and Kutlaku Lakes on Kuiu Island, produce estimated runs of a few thousand fish. Although the total run size is not known, escapements in two intermediate systems which had enumeration weirs, Karta Lake on eastern Prince of Wales Island and Salmon Bay Lake on northeast Prince of Wales Island, averaged 18,400 and 18,000 sockeye salmon, respectively (1982 to 1988 average, excluding 1984 when the weirs were not installed). The single largest producer of sockeye salmon in recent years in southern Southeast Alaska has been McDonald Lake in upper Behm Canal. Estimated escapements to this system have ranged from 56,000 in 1983 to 175,000 in 1987 and averaged 113,500 (1981 to 1988 average, excluding 1982 when the weir washed out).

The Stikine River (Figure 3) originates in British Columbia and flows through the Alaskan panhandle into Frederick Sound north of Wrangell. It is therefore a transboundary river, i.e., a river that flows through Canada and the U.S. Approximately 90% of the river system is inaccessible to anadromous fish because of natural barriers and velocity blocks. The majority of the accessible sockeye spawning habitats are located above the U.S./Canada border. The largest single contributor to the Stikine River sockeye run is Tahltan Lake. Sockeye escapements enumerated at the weir have ranged from 1,800 fish in 1963 to 67,300 fish in 1985 and averaged 19,841 fish (1959–1988, excluding 1962 when the weir installation date was unspecified and 1965 when a large slide hindered access into the lake; TTC 1990). The remainder of the Stikine River sockeye stocks—i.e., the non-Tahltan Stikine stock group—spawn in small lakes, sloughs, and side channels of the mainstem river and its tributaries, most of which are glacially occluded. Estimates of the non-Tahltan Stikine sockeye escapement have ranged from 13,400 in 1979 to 63,000 in 1985 and averaged 36,180 fish (1979–1988).

The Nass and Skeena Rivers have contributed substantial numbers of sockeye salmon to the District 106 and 108 harvests in some years. Estimated catches of Nass/Skeena fish have ranged from 10,000 to 111,000 fish since 1982. The Nass River originates in British Columbia and drains into Portland Canal just south of the U.S./Canada border. Estimated sockeye escapements to this system have averaged 218,800 from 1980 to 1988. The Skeena River also originates in British Columbia and drains into the ocean about 50 km south of the Nass River. Estimated sockeye escapements have averaged 1,186,800 from 1980 to 1988 (DFO 1986; NBTC 1988).

Stock Separation Studies

The United States and Canada initiated research programs in 1982 to assess the feasibility of various stock separation techniques applicable to sockeye salmon stocks harvested by both countries. Several methods of stock separation have been used, including the incidence of the parasite *Myxobolus arcticus*, differences in genotypes, adult tagging studies, and scale pattern analysis. Of these, scale pattern analysis has been used most extensively to determine stock composition of the harvests in Alaskan mixed stock commercial fisheries (Oliver et al. 1984; Oliver and Walls 1985; Oliver and Jensen 1986; Jensen and Frank 1988; Jensen et al. 1989; Jensen and Frank 1993).

Scale pattern analysis has generally proven successful in determining the contribution rates of sockeye stocks to Southeast Alaskan commercial fisheries because of significant and persistent differences in the freshwater and early marine growth among stocks originating in various Alaskan and Canadian systems. The original stock groupings used by ADF&G to estimate stock composition in District 106 and 108 were the Alaska group, composed of samples taken from 22 to 28 Alaska escapements; the Nass/Skeena group, composed of samples taken from inriver test fisheries on the Nass and Skeena Rivers; and the Stikine River group, composed of scale samples collected from the Canadian inriver commercial fishery. The stock groupings were expanded in 1983 by creating separate standards for the Tahltan Lake stock and for the non-Tahltan Stikine stock group. The non-Tahltan group was composed of samples from mainstem river and side slough spawners and Chutine, Skud, and Iskut River spawners. Standards were further refined in 1986 to separate two distinct patterns: Alaska I, typified by Hugh Smith Lake and Luck Lake patterns, and Alaska II, typified by the McDonald Lake pattern.

METHODS

Numbers of Fish

Catch statistics for Districts 106 and 108 were obtained from ADF&G records of fishery sales receipts, i.e., *fish tickets*. Catches were reported by fishing period and were assigned to a statistical week, beginning at 0001 hours Sunday and ending the following Saturday at 2400 hours. Weeks were sequentially numbered beginning with the first Sunday of the calendar year.

Collection and Preparation of Scale Samples

Scales were taken from the left side of the fish approximately three rows above the lateral line along a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963). Scales on salmon fry first develop in this area, therefore, these scales are preferred for purposes of aging and digitizing. Scales were mounted on gum cards and impressions made in cellulose acetate (Clutter and Whitesel 1956).

Employees of the ADF&G, Commercial Fisheries Division, sampled District 106 and 108 catches at fish processing plants in the communities of Petersburg and Wrangell, Alaska. Samplers recorded the sex of each fish sampled and collected one scale per fish. The Canadian inriver commercial and test fishery catches were sampled by DFO employees who recorded the sex of each fish sampled and took five scales according to DFO sampling guidelines.

Similar procedures were used to sample escapements; three scales per fish were taken by ADF&G employees from fish sampled from 13 lake systems throughout southern and central Southeast Alaska. Escapements sampled at enumeration weirs were collected throughout the run and other systems were sampled during a 2- to 3-day trip to the spawning grounds. Two scales per fish were collected by DFO personnel from test fishery samples taken at the mouths of the Nass and Skeena Rivers, and five scales per fish from the Tahltan Lake escapement and the Stikine River test and commercial fisheries. Samples were collected periodically throughout the run from all areas sampled by DFO personnel. Sex was determined by examination of external sexual maturation characteristics, including kype development, belly, vent, and jaw shapes, or, when possible, by examination of gonads. A study conducted by ADF&G to determine the accuracy of its samplers in sexing ocean-caught salmon showed that an average of 94% of sockeye salmon sampled were sexed correctly. We believe the accuracy of sex determination of sockeye salmon captured inriver or on the spawning grounds is higher than for marine catches because their secondary maturation characteristics are more pronounced.

The scale sampling goals for the Subdistrict 106-41 and 106-30 harvests were set at 350 fish per statistical week and for District 108 at 700 fish per week. This enabled the proportion of each major age group in the catch during each fishing period to be estimated to within 5% of the true proportion 95% of the time (Thompson 1987). Sample goals were slightly higher than the minimum required number to account for a scale regeneration rate of approximately 20%, and to ensure that adequate numbers of scales from minor age classes were available each week for digitizing. Sampling goals were met for most fishing periods in the District 106 commercial fishery. Low catches and limited availability of fish in the District 108 fishery prevented us from achieving our desired sampled sizes in each fishing period for this district. Sample goals for Southeast Alaska sockeye salmon escapements were 520 fish per system with the exception of McDonald Lake where the goal was 1,000 fish. DFO collected scales from all sockeye salmon taken in the lower Stikine River test fishery and from 350 sockeye salmon per week from the lower river commercial catches. Samples from the Stikine River test and commercial fisheries were paired with brain parasite prevalence for all fish and egg diameter measurements for females. DFO sampled approximately 830 sockeye salmon throughout the season from fish passing through the Tahltan Lake enumeration weir and 1,177 and 1,248 from the Nass and Skeena River test fisheries (Figure 1).

Age Composition

Fish ages were determined by visually examining scale impressions magnified 70X on a microfiche reader and were recorded in European notation. Criteria used to determine ages were similar to those of Moser (1968).

Scales from fish sampled on the spawning grounds occasionally exhibited resorption along the outer edges, making the determination of ocean age impossible without additional information. The relationship between fish length and marine age of sockeye salmon provided a valuable tool in determining marine ages. Fish length is highly correlated with marine age, and for a given age class, females are typically smaller than males (Rowse and McPherson *in press*). In cases where scale resorption was severe, sex-specific length frequency histograms were used to assist in determining the correct marine age. Little overlap in length frequency distributions by marine age generally occurred within stocks (ADF&G, Commercial Fisheries Division, Douglas, unpublished data). For this reason fish length was recorded for every sample taken from escapements.

Scale Digitizing

Scale images magnified 100X were projected onto a digitizing tablet using equipment similar to that described by Ryan and Christie (1976). Scale measurements were made and recorded with a microcomputer digitizing system using customized software.

Previous studies have established that an axis approximately perpendicular to the anterior edge of the unsculptured posterior field is best for consistently measuring sockeye scales (Clutter and Whitesel 1956; Narver 1963). This axis is approximately 20° dorsal or ventral from the anterior-posterior axis, and all circuli counts and scale measurements in the lacustrine and first-year marine zone were made along it. Marshall et al. (1984) established the separability of major stock groups in southern Southeast Alaska by measurements in three or four zones: (1) the first freshwater—the scale center to the last circulus of the first freshwater annulus, (2) the second freshwater—when present, the first circuli of the second year of freshwater growth to the end of the second freshwater annulus, (3) the plus growth—scale growth after the last freshwater annulus and before the first marine circulus (Moser 1968), and (4) the first year marine growth—the first marine circulus to the end of the first marine annulus (Figure 4). A total of 74 variables including circuli counts, incremental distances, and ratios and/or combinations of the measured variables were calculated for scales which had a single freshwater annular zone. For scales with two freshwater annular zones 106 variables were calculated (Appendix A).

Discriminant Function Analysis

Linear discriminant function analysis (LDF) is a multivariate technique that develops classification rules used to assign a sockeye salmon sampled in a mixed stock fishery to its stock of origin. The variables calculated from circuli counts and incremental distances on scales from fish of known origin provide a set of measurements used to define these rules. A sample of p selected scale variables from a number of fish in a stock or stock group defines a single region in p-space characteristic of that group of fish. The set of all p-dimensional vectors of measurements for the population forms a multivariate distribution. Discriminant analysis derives the decision surfaces that "best" discriminate between or separate the populations. A sockeye salmon harvested in a mixed stock fishery is classified according to which region its p-dimensional vector occupies. The accuracy of classification depends upon the precision with which the regions defining each stock or group are described and the inherent separations between them. The LDF is the linear combination of p observed variables which maximizes the between-group variance relative to the within-group variance (Fisher 1936).

Assuming that the groups being investigated are discrete and identifiable, the parent distributions of the measured variables are multivariate normal, and the variance-covariance matrices for all groups are equal, LDF provides the best discriminant rule in the sense of minimizing the expected probability of misclassification. Gilbert (1969) found LDF satisfactory if the variance-covariance matrices were not too different. In addition, large sample sizes appear to make the LDF robust to the assumption of common variance-covariance matrices (Issacson 1954; Anas and Murai 1969). The method is apparently robust to violations of the normality assumption for some discrete distributions; however, it is not robust for continuous non-Gaussian parent distributions (Lachenbruch et al. 1973; Krzanowski 1977). Unpublished results from ADF&G studies which compare LDF, quadratic discriminant analysis (QDF), nearest neighbor analysis (NN), and maximum likelihood estimation (MLE) indicate that LDF has a higher classification accuracy than QDF or NN and an accuracy nearly identical to MLE when tested on the stock groups described in this paper. This indicates that for the variables used in scale pattern analysis of Southeast Alaska mixed stock sockeye catches the assumptions for LDF are met or LDF is robust.

Scale variables used in LDF are selected with a stepwise procedure. In this process variables are added until the partial F-statistic of all variables available for entry into the model is <4.0 and all variables in the model have F-values >4.0 (Enslein et al. 1977). An almost unbiased estimate of classification accuracy for each LDF is determined using a leaving-one-out procedure (Lachenbruch 1967). One sample is "left out," the discriminant rule is estimated, and the "left out" sample is classified using the discriminant rule and checked to see if it was classified correctly. This procedure is repeated for all samples. Thus, when an LDF is run using the leaving-one-out procedure, a classification matrix is developed which gives the proportions of correctly identified fish and the proportions of misclassification of each stock to each of the other stocks.

When more than two stock groups are being analyzed, the stepwise procedure does not always result in maximum classification accuracies or the most balanced classification matrix. Frequently, well separated groups are separated even further, but poorly separated groups remain poorly separated (Habbema and Hermans 1977). Scale variables that provide the best discrimination between the groups that most often misclassify as each other are occasionally added to or substituted for other variables used in the LDF to provide either a better balance to the classification matrix or to increase the mean classification accuracy.

The proportional estimates of stock composition in the mixed stock harvests, referred to as *initial estimates*, are adjusted with a classification matrix correction procedure (Cook and Lord 1978). The fish in the mixed stock sample are classified with the LDF. The vector of proportional estimates for each stock or stock group is multiplied by the inverse transposed classification matrix to give new estimates, referred to as *adjusted estimates*, for the true proportions of stocks and stock groups in the mixed stock fishery. In cases where the adjusted estimated proportion for a stock group is less than zero, the entire catch sample is reclassified with a function excluding that stock group. This process is repeated until all adjusted estimated proportions are positive.

The variance and 90% confidence intervals of the adjusted estimates of stock proportions were computed according to Pella and Robertson (1979). The variance-covariance matrices for the misclassification matrix and for the mixed stock proportions vector are determined from the multinomial probability distribution. These two variance-covariance matrices are combined to give variances and covariances for the adjusted estimates of stock proportions. The variances for the proportions of each stock are the diagonal elements of this combined matrix, i.e., they are an additive combination of the sampling variation in estimating the probability of assignment of the known stock group and the sampling variation in estimating the assignment composition of the mixed stock group.

Developing Standards

In 1989 four major age classes—1.2, 1.3, 2.2, and 2.3—contributed 99% of the catch in District 106 and 77% of the catch in District 108. The remaining 23% of the District 108 catch was composed of age-0. fish. Age-specific discriminant functions, where standards from a specific age class were used to classify catches of fish of the same age class, were used in the analysis to account for differences in age composition among stocks, remove potential bias due to differences in migratory timing of different age fish, and eliminate the effect of different environmental conditions on the scale patterns of different age fish. Standards were developed for each age class for the Alaska I and Nass/Skeena stock groups, for age-1.2, -1.3, and -2.3 for the Tahltan, and Non-Tahltan Stikine groups and for age-1.3 for the Alaska II group. The desired sample size for each age-specific standard was 200 fish per stock. Unpublished ADF&G studies show that, over a wide range of classification accuracies, only a minimal decrease in the variance of stock composition estimates was achieved by enlarging sample sizes of standards above 200. We achieved this sample size goal for age-1.3 fish for all stock groups; however, for age-1.2, -2.2, and -2.3 fish we often did not have 200 samples (Appendices B.1–B.4).

Two standards, Alaska I and Alaska II, were developed to represent the Alaskan coastal stocks. Samples from 12 sockeye systems in central and southern Southeast Alaska were pooled to create the Alaska I standard. The number of samples included from each system was weighted by perceived run strength, geographic proximity of the system to District 106 and 108, and known migratory pathways. Although only samples from McDonald Lake were used to develop the Alaska II standard, classification studies have indicated that high portions of some other Alaskan systems, including Karta, Salmon Bay, and Naha Lakes will classify as Alaska II. Standards for the Nass/Skeena stock group were developed with scales sampled from gillnet test fisheries near the mouths of each river, using scales chosen in proportion to migratory timing as indicated by test fishery CPUE. The Tahltan Lake standards were developed from scale samples collected (1) throughout the migration of fish past the Tahltan Lake weir weighted by fish abundance passing through the weir and (2) from fish caught in the Lower Stikine commercial and test fisheries (Figure 3) which had small diameter eggs and did not have the brain parasite *Myxobolus arcticus*. The non-Tahltan Stikine standards were developed from scales collected from females with large diameter eggs and from females and males which had brain parasites.

Because this was the first year in which the Tahltan and non-Tahltan standards were not collected solely from the spawning grounds or the weir, we analyzed the scale patterns of the two stock groups. Scale measurements from the two Tahltan groups and the three non-Tahltan groups were analyzed with both univariate and multivariate analysis of variance (ANOVA/MANOVA) using PROC GLM in SAS (SAS Institute 1989) to determine if there were significant differences ($\alpha = 0.05$) in variable means. Tests were run for the three non-Tahltan groups, the two Tahltan groups, and the contrast between the Tahltan and non-Tahltan groups as a whole. Variables included the number of circuli in and the width of the first annular zone, the freshwater zone, and the first marine zone. The F-statistic was used to test for overall univariate differences and Wilks' lambda (Johnson and Wichern 1988) was used to test for overall multivariate differences. The Ryan-Einor-Gabriel-Welsch multiple range (REGWQ) test (Day and Quinn 1989) was used to test for all pairwise univariate differences. Pairwise multivariate differences within the non-Tahltan group and for contrast between the Tahltan and non-Tahltan groups were tested by assessing the Bonferroni-adjusted significance (Johnson and Wichern 1988) of Wilks' lambda for each combination. The adjusted significance level for this procedure is $\alpha = 0.0167$ for the non-Tahltan comparisons and $\alpha = 0.005$ for the contrast among Tahltan and non-Tahltan groups. Finally, the assumptions of univariate and multivariate normality and homogeneous variances of the residuals were examined through the use of residual plots and variable transformations.

The samples used to build the standards used in inseason analysis in 1989 were collected from test fishery catches and spawning ground activities in 1988. Samples for the Alaska I, Alaska II, and Nass/Skeena stock groups were collected in a manner similar to that used in 1989. The 1988 Tahltan standard was built from scales sampled at Tahltan weir only and the non-Tahltan Stikine standard was created from samples collected from escapements to tributaries and from sloughs along the mainstem of the Stikine River.

Classification of Catches

Commercial catches were analyzed inseason with discriminant functions developed from the previous year's escapement standards of the same age class. Stock contributions for the Subdistricts 106-30 and 106-41 and the District 108 commercial catches were estimated and summaries were provided to managers within 48 h of the fishery closures between mid-June and mid-August. Only the age-1.3 catch component was analyzed inseason. This age class represented 73.9% of the 106-30 catch, 75.1% of the 106-41 catch, and 66.3% of the 108 catch. An additional 23.0% of the District 108 catch was composed of age-0. fish which were assumed to be of non-Tahltan Stikine origin. Commercial catches which had occurred after the cessation of the inseason analysis (early August) were classified postseasonally.

Stock contributions were estimated for each week to track temporal patterns; however, in some weeks catches were small and samples of the less common age groups were insufficient for classification unless they were pooled with the adjacent week's sample. The proportion of each stock in a week's catch sample was expanded to the week's catch by

$$C_{ijt} = C_t \cdot P_{it} \cdot S_{ijt} ,$$

where:

C_{ijt} = estimated catch of fish of age i in group j in period t,

C_t = total catch in period t,

P_{it} = estimated proportions of fish of age i in the catch in period t, and

S_{ijt} = proportion of fish of age i and estimated with LDF to be in group j in the catch in period t.

To estimate stock composition of the minor age groups not classified with LDF, we assumed that the proportion of the minor ages belonging to any given stock in a catch was equal to the proportion of all LDF-classified age classes of that stock in the catch, such that

$$C_{mjt} = C_t \cdot P_{mt} \cdot S_{ljt} \quad ,$$

where:
C_{mjt} = estimated catch of fish of minor age class *m* of group *j* in period *t*,
P_{mt} = estimated proportion of fish of minor age group *m* in the catch in period *t*, and
S_{ljt} = proportion of fish estimated with LDF (all analyzed ages combined) to be in group *j* in the catch in period *t*.

Age-0. fish were absent or extremely rare in most stock groups, except for the non-Tahltan Stikine group. Because Stikine River stocks have historically composed 70% or more of the District 108 catch and the non-Tahltan Stikine group typically has a strong (>10%) age-0. component, all the age-0. fish in the District 108 catch were assumed to be of non-Tahltan Stikine origin.

The variances of the weekly and seasonal stock composition estimates were approximated with the Delta method (Seber 1982). The variance estimates are functions of (1) the accuracy of the age-specific functions used to classify the unknowns, (2) the sample size of each standard used to develop age-specific discriminant functions, (3) the proportions of each stock in the initial and in the adjusted stock composition estimates, (4) the age-specific stock composition sample sizes, (5) the age composition sample sizes, and (6) the catch size. However, the estimates are minimum estimates of variance because they do not include (1) any variance associated with the age classes not classified with LDF, (2) any variance for stocks contributing no fish during a given week, or (3) any estimates of aging errors or inaccuracies in catch reporting. Variances of proportions of stock contributions are calculated with formulae from Pella and Robertson (1979).

Test Fishery Catches

Test fisheries were operated in Subdistrict 106-30 form mid-August through mid-September and in Subdistrict 106-41 and District 108 from mid-June through early August in 1989. Test fishery catches were not sampled; therefore, weekly age and stock compositions estimated for the commercial catches were used to estimate stock compositions of test fishery catches for the same time/area strata.

Comparison of Inseason and Postseason Estimates

Adjusted inseason stock composition estimates were compared to postseason estimates for the District 106 and 108 catches. The weekly inseason estimates were derived in a different manner than were the postseason methods. The inseason stock compositions were estimated only for age-1.3 fish, whereas the postseason estimates were based on age-1.2, -1.3, -2.2, and -2.3 fish.

The actual numbers of fish in the samples that were classified to each group in the inseason analysis were compared to those in the postseason analysis. Chi-square analysis was deemed inappropriate because the data did not conform to the general rule that none of the expected frequencies should be <5.0 (Cochran 1954; Roscoe and Byars 1971). Log-likelihood ratio analysis is not as sensitive to small frequencies (Zar 1984) and was therefore deemed the more appropriate analysis to use. One was added to each cell count to avoid calculating the logarithm of zero.

In addition to comparing the weekly inseason estimates with the weekly postseason estimates, the set of weekly differences was also tested for heterogeneity (Sokal and Rohlf 1981). Significant heterogeneity indicates either differences in sign or magnitude among the weekly differences. If there is no significant heterogeneity, the sum of the weekly G statistic may be used to test for an overall seasonal difference.

Because the same scales used for the inseason estimates were also used (along with additional scales) for the postseason analysis, the G-test described above is not entirely appropriate. This test assumes independent samples, i.e., a different set of scales for the inseason and postseason analysis. Because the samples are not independent, the G-test will tend to be conservative (the alpha level will be less than the stated 0.05); hence, tests may not be declared significant when they really are. Unfortunately, methods which correctly take into account the dependencies among samples (Agresti 1990) require that each scale be assigned to a specific stock. Although discriminant analysis makes such an assignment, the subsequent adjustments to estimate the mixing proportions deal with proportions rather than with individual fish, such that the individual assignments are lost.

In light of the above, test results are presented merely as flags to bring attention to differences that may need further examination. In fact, it is often the case that significant test results may not correspond to a practical significant difference.

RESULTS

Significant differences in marine growth were found among the three stock groups used for the non-Tahltan standard. However, the non-Tahltan standard as a whole was also significantly different from the Tahltan standard (Table 1). The stock compositions of the sockeye salmon caught in Subdistricts 106-30 and 106-41 and in District 108 were estimated from mid-June through late August, statistical weeks 26–35. Of the 202,817 sockeye salmon harvested in Districts 106 and 108, 24.7% were of Alaska

I origin, 38.3% of Alaska II, 29.8% of Nass/Skeena, 0.7% of Tahltan, and 6.4% of non-Tahltan Stikine origin (Table 2). Mean classification accuracies ranged from 60.7% for a five-stock function to 90.3% for a two-stock function (Table 3; Appendix B). The inseason stock composition estimates differed significantly from the postseason estimates during all weeks for the District 106 and 108 fisheries (Table 4).

Tahltan and non-Tahltan Standards

The ANOVA of the non-Tahltan scales indicated that there were no significant differences for the freshwater variables but that means for the marine variables were different (Table 1). The REGWQ test indicated that the parasitized females were different from the other two groups for the marine circuli count and were different from the large egg females but not from the parasitized males for the marine distance. MANOVA also indicated significant differences. There were no significant univariate or multivariate differences for the two Tahltan groups. The contrast indicated that there were highly significant differences between the Tahltan and non-Tahltan groups; the REGWQ indicated that the only overlap between groups occurred for the marine circuli count for the parasitized female non-Tahltan fish and the small-egg-diameter Tahltan females. The MANOVA also indicated that the two groups were significantly different.

Examination of assumptions showed that most of the variables were not normally distributed. However, because of the relative robustness to non-normality of the procedures used, the large sample size, and because logarithmic and square-root transformations did not appreciably change the test outcomes, we feel that our results are insensitive to the violation of this assumption. Variances were found to be homogeneous within stock groupings and between groups for all variables except for the widths of the first annular and the freshwater zones. The assumption of homogeneous variances is thus only violated for the univariate and multivariate contrast between groups. Because of the large and nearly equal sample sizes, the fact that the larger group variance (for non-Tahltan) is associated with the larger group sample size, and because of the high level of significance attained, we feel that our results are insensitive to the violation of this assumption as well.

Subdistrict 106-30 Catches

A total of 84,848 sockeye salmon were harvested in Alaskan Subdistrict 106-30 drift gillnet fishery in 1989. An estimated 66.1% were of Alaska I and Alaska II origin, 32.2% were of Nass/Skeena origin, and 1.7% were of transboundary Stikine River origin (Appendix C.1). The Alaska I stock group was the most abundant group in the catch during mid- to late June and remained at more than 10% of the catch throughout the season. The Alaska II group dominated the catch from mid-July through mid-August and contributed a substantial fraction of the catch during all weeks. The Nass/Skeena stock group consistently composed from 20% to 40% of the catch throughout the season and was the most abundant stock in early July and during the final weeks of the season. Tahltan fish were not present after mid-July, and non-Tahltan Stikine fish composed a small portion of the catch throughout the season.

Catches and CPUE for all stocks were low during the first 3 weeks of the season from mid-June through early August. The catch and catch per boat day peaked for all stock groups during weeks 28 and 29 (Appendix C.2). The catch of the Alaska II stock, by itself, exceeded 100 fish per boat day during week 29.

Subdistrict 106-41 Catches

Of the 107,886 sockeye salmon harvested in the Subdistrict 106-41 drift gillnet fishery in 1989, 65.2% were of Alaska I and Alaska II origin, 30.3% were of Nass/Skeena origin, and 4.5% were of transboundary Stikine River origin (Appendix C.3). The Alaska I or Alaska II stock groups dominated the catch during all weeks except weeks 25 and 27 and the final weeks of the season when the Nass/Skeena stocks were the most abundant fish in the catch. The Tahltan stock group was present in small numbers in weeks 25 through 27, and non-Tahltan fish composed a small portion of the catch throughout the season and contributed 16.0% of the early July catch.

The catch per boat day peaked during week 29 at 147 fish. The peak CPUE for the Alaska I stock group occurred in week 29 whereas that of the Alaska II and Nass/Skeena groups occurred a week earlier. Peak CPUE for the Tahltan and non-Tahltan stock groups occurred during weeks 26 and 27, respectively (Appendix C.4).

District 108 Catches

Of the 10,083 sockeye salmon harvested in the District 108 drift gillnet fishery, 11.8% were of Alaska I and Alaska II origin, 5.4% were of Nass/Skeena origin, and 82.8% were of transboundary Stikine River origin (Appendix C.5). The non-Tahltan Stikine group dominated the catch during all weeks after early July. The other stock groups contributed substantial proportions of the catch during June, but the total catch during the first 2 weeks of the fishery was only 447 fish. The fishery was not open during week 27 in early July.

The highest CPUE for the season occurred during week 28 with 208 fish per boat day, of which an estimated 162 fish were of non-Tahltan Stikine origin (Appendix C.6).

Test Fishery Catches

The test fisheries in Subdistrict 106-30 and 106-41 and District 108 caught 37, 2,043, and 1,038 sockeye salmon. An estimated 1,430 Alaskan, 726 Nass/Skeena, and 999 transboundary Stikine River fish were taken in all test fisheries combined (Appendices C.7–C.9).

1989 Stock Compositions Compared to Historical Data

The District 106 sockeye catch of 192,734 fish in 1989 was higher than in 5 of the last 7 years, was similar to the 1982 harvest, but was well below the 1985 harvest of 265,067 fish (Appendix D.1). The three major stock groups Alaska I, Alaska II, and Nass/Skeena were numerically and relatively more balanced in abundance than in 1982 through 1988. The transboundary Stikine River fish were numerically more abundant in 1989 than in 1986 through 1988 but composed nearly the same fraction of the catch as in those years (Appendix D.2).

Sockeye catches in Subdistrict 106-30 were lower than in Subdistrict 106-41 as has been observed since 1985 (Appendix D.3). The catch of Alaska I fish was near average in Subdistrict 106-41 but was lower than any year since 1986 in Subdistrict 106-30. The catches of Alaska II and Nass/Skeena fish in both subdistricts were high, both numerically and relatively compared to 1985 through 1988 (Appendix D.4).

The sockeye catch in District 108 was the highest observed since stock composition analysis was initiated in that district in 1986 (Appendix D.5). The non-Tahltan Stikine stock group was numerically more abundant than in prior years and relatively more abundant than in 1987 or 1988.

Comparison of Inseason and Postseason Estimates

The inseason stock composition estimates differed significantly from the postseason estimates all weeks in all fisheries (Table 4; Appendix E). The contribution of Alaska stocks was overestimated and the contribution of Nass/Skeena stocks was underestimated throughout the season in Subdistricts 106-30 and 106-41 and in District 108. There was no consistent trend in the estimation of Stikine River fish in District 106; however, these stocks were underestimated in District 108. Heterogeneity was not significant in Subdistrict 106-30 or 106-41 but was significant in District 108. Total season differences were also significant in District 108. The inseason analysis did correctly indicate that the Alaska fish were the most abundant component of the District 106 catch and overestimated the Stikine River component by only 5.1% in Subdistrict 106-30 and 0.5% in 106-41 (Appendix E.1). The inseason analysis of District 108 catches correctly indicated that Stikine River fish dominated the catch, but underestimated the Stikine contribution by 33.3%.

DISCUSSION

In past years the Tahltan standards were developed from scales sampled from fish migrating past the weir at Tahltan Lake and the non-Tahltan standards were built from scales collected from various spawning grounds in the mainstem Stikine River, tributary lakes and rivers, and side sloughs. The spawning ground scale collection activities were expensive and we were not sure that they represented all major spawning populations of non-Tahltan sockeye salmon. Studies of egg diameters (Craig 1985) and brain parasite prevalence (Moles et al. 1990) have shown that these characteristics could be used to identify Tahltan and non-Tahltan fish in the river before the fish reached their final spawning destination. There has been no incidence of the brain parasite in fish sampled at Tahltan Lake weir, whereas various populations which spawn elsewhere in the Stikine River have varying rates of parasite prevalence. Thus, a parasitized fish can be assumed to be of non-Tahltan origin but the origin of a non-parasitized fish is not known. The Tahltan fish have eggs which are smaller in diameter than other Stikine River stocks. A few fish sampled at Tahltan weir have had large eggs, and there has been little verification of the egg diameter of non-Tahltan populations. The stock compositions estimated with scale pattern analysis of inriver catches have been very close to those estimated with egg diameter analysis. Although it is possible that there are non-Tahltan stocks with small-diameter eggs, it is not likely that they are very abundant. Less than 3% of the fish sampled for egg diameters had brain parasites. In addition, the migratory timing of the small-egg-diameter fish is not significantly different from that of the Tahltan fish (estimated from scale pattern analysis). We realize that egg diameter is not a perfect stock identification technique because a few fish sampled from catches had small diameter eggs and parasites, some Tahltan fish had large diameter eggs, and we have no quantative data on the egg diameter of non-Tahltan stocks. However, we feel that the former method of collecting non-Tahltan samples from selected sites with the more than 100k of potential spawning grounds was probably not completely representative of the non-Tahltan escapement. We felt that by comparing the scale patterns of Tahltan weir escapement samples with the patterns of scales sampled from nonparasitized females with small diameter eggs we would be able to ascertain if test and commercial catch samples could be used to augment the weir samples for the Tahltan standard. Similarly, we felt that if the nonparasitized females with large diameter eggs, the parasitized females, and the parasitized males sampled from the catches had scale patterns that did not differ significantly from each other, then they would more accurately represent the non-Tahltan escapement than would samples collected from a few spawning grounds.

The lack of significant differences for the two Tahltan groups indicated that females with small-diameter eggs did not differ from the overall spawning escapement past Tahltan weir. Our analysis indicated that there were significant differences in marine growth among the three non-Tahltan groups. However, the non-Tahltan groups were significantly different from the Tahltan groups for all pairwise comparisons, except for the circuli count in the first marine zone where the parasitized females were not significantly different from the small-egg, non-parasitized females. Because the MANOVA indicated that the Tahltan and non-Tahltan groups were significantly different, we concluded that the egg diameter and brain parasite data were sufficient indicators of stock origin to be used to construct the two scale pattern standards.

The estimated catch of 13,077 non-Tahltan Stikine fish was the largest since this stock group was included in the analysis in 1983. The high catch was attributable to the 29 days fished in District 108; the longest season since 1972. The estimated inriver run of 60,944 fish was also the largest since 1985. The low Tahltan catch, 1,451 fish, corresponded with the low inriver run estimate of 14,110 fish.

The primary use of the inseason analysis is to estimate the catch of Stikine River sockeye salmon in Alaskan Districts 106 and 108. This estimate is input into a management model, and fishery managers in the U.S. and Canada use the model results to manage fisheries to comply with Pacific Salmon Treaty regulations. Ancillary data, including age composition, catches in the Stikine River, and historical patterns of abundance and migratory timing, can be used to estimate how well the inseason analysis is working.

The low inseason estimates of Nass/Skeena fish compared to abundances in prior years indicated that there were potentially large misclassification problems. The inseason analysis indicated that well over half the District 106 catch was of Alaska I origin and the combined Alaska I and Alaska II stock groups composed 70% to 90% of the catch. The age compositions indicated that average (1982–1988) numbers of fish of ages other than 1.3 were caught. Because the Alaska stocks are dominated by age-1.3 fish and the Nass/Skeena stocks typically have high abundances of age-1.2, -2.2, and -2.3 fish it seemed likely that the inseason analysis was overestimating the contribution of the Alaska stocks and underestimating the contribution of Nass/Skeena stocks. Fishery managers were notified of the potential misclassifications and were provided with ancillary age composition data. The misclassification problems were verified in the postseason analysis.

The inseason analysis worked fairly well in predicting the Tahltan and non-Tahltan Stikine contributions. The analysis underestimated the Stikine River catch by 5,282 fish but did not result in U.S. catches being out of compliance with the U.S./Canada Pacific Salmon Treaty.

The inseason analysis worked well in 1986 through 1988 and it is not readily apparent why the errors were large in 1989. The use of only age-1.3 fish in 1989, compared to the three age classes (1.2, 1.3, and 2.3) used previously, may have contributed to the problem. If age-1.2 and -2.3 fish had been included in the inseason analysis the under and overestimates may have occurred for different stocks and acted to balance the total estimates.

Interannual differences in growth rates and scale patterns of the different stock groups may be caused by many factors including climate, competition for resources, and food supply and are reflected by differences in average values for scale variables for a given stock. The magnitude of these types of interannual variation within and between stock groups determines how well the inseason stock composition estimates predict the postseason estimates. An unknown, but hopefully small component of interannual variation may also be contributed by changes in perception of growth by the digitizer through time. We attempt to minimize this source of variation by following a rigid set of digitizing criteria including measurements along a consistent axis, standard methods for definition of scale zones, and informal testing of digitizer consistency. A digitizer will occasionally redigitize a small sample of scales to determine consistency of measurements. If persistent differences occur, digitizing perception and criteria are reevaluated.

Research is being initiated to refine the inseason stock composition analysis. It may be possible to find some method of incorporating ancillary data or account for interannual variation within stocks.

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Table 1. Means of scale variables and univariate and multivariate comparisons within and between non-Tahltan and Tahltan scale collections based on egg diameter, parasite presence and sex of sockeye salmon from the Stikine River, 1989.

	Means					Ryan-Einot-Gabriel-Welsch (REGWQ)				
Variable	1	2	3	F-Stat	Pr>F	1	2	3	4	5
Non-Tahltan										
1	9.32	9.52	9.48	0.40	0.6675	A	A	A		
2	92.89	97.56	99.07	2.80	0.0624	A	A	A		
65	11.91	11.99	11.95	0.04	0.9642	A	A	A		
66	116.25	120.31	122.70	2.13	0.1206	A	A	A		
70	31.36	31.03	29.96	5.95	0.0029	A	A	B		
71	454.33	446.94	439.31	3.75	0.0246	A	AB	B		
Manova: Wilks' Lambda = 0.917610				2.14	0.0134					
Pairwise Bonferroni-adjusted comparisons						A	AB	B		
	4	5								
Tahltan										
1	13.51	13.58		0.06	0.8010				C	C
2	133.93	135.23		0.40	0.5270				C	C
65	15.27	15.55		1.27	0.2601				C	C
66	147.36	150.62		2.34	0.1280				C	C
70	29.47	28.88		2.70	0.1017				C	C
71	405.59	406.10		0.01	0.9123				C	C
Manova: Wilks' Lambda = 0.956436				1.56	0.1616					
Pairwise Bonferroni-adjusted comparisons									C	C
	All non-Tahltan	All Tahltan								
Non-Tahltan and Tahltan: Contrast										
1	9.44	13.55		710.37	0.0001	A	A	A	C	C
2	96.51	134.54		580.78	0.0001	[a] A	A	A	C	C
65	11.95	15.40		376.67	0.0001	A	A	A	C	C
66	119.75	148.90		270.27	0.0001	[a] A	A	A	C	C
70	30.78	29.19		39.39	0.0001	A	A	B	BC	C
71	446.86	405.83		154.54	0.0001	A	AB	B	C	C
Manova: Wilks' Lambda = 0.346000				158.14	0.0001					
Pairwise Bonferroni-adjusted comparisons						[a] A	A	A	C	C

Variable codes:
- 1 = circuli count in first annular zone
- 2 = width of first annular zone
- 65 = circuli count in freshwater zone
- 66 = width of freshwater zone
- 70 = circuli count in first marine zone
- 71 = width of first marine zone

Stock Codes:
- Non-Tahltan: 1=large egg, non-parasitized 2=parasitized male 3=parasitized female
- Tahltan: 4=small egg, non-parasitized 5=weir escapement

REGWQ codes:
Variable means with the same letter are not significantly different.

[a] The variances are homogeneous among the non-Tahltan and among the Tahltan groups, however, they are heterogeneous for the pairwise (non-Tahltan vs Tahltan) comparisons. Heterogeneity may affect test results for pairwise comparisons.

Table 2. Estimated contributions of sockeye salmon stock groups to Alaskan District 106 and 108 drift gillnet fisheries, 1989.

Dates	Stock Group	Catch by District 106-30	106-41	108	Total	Percent[a]
6/18-6/24 Week 25	Alaska I	603	925	[b]	1,528	24.5
	Alaska II	175	1,544		1,719	27.6
	Nass/Skeena	344	2,114		2,458	39.4
	Tahltan	27	163		190	3.0
	Stikine	39	303		342	5.5
	Total	1,188	5,049		6,237	
6/25-7/01 Week 26	Alaska I	756	2,623	46	3,425	37.3
	Alaska II	386	943	30	1,359	14.8
	Nass/Skeena	545	2,098	97	2,740	29.9
	Tahltan	0	592	110	702	7.7
	Stikine	87	697	164	948	10.3
	Total	1,774	6,953	447	9,174	
7/02-7/08 Week 27	Alaska I	649	2,159	Not Open	2,808	28.3
	Alaska II	914	1,503		2,417	24.4
	Nass/Skeena	766	2,351		3,117	31.5
	Tahltan	13	202		215	2.2
	Stikine	158	1,187		1,345	13.6
	Total	2,500	7,402		9,902	
7/09-7/15 Week 28	Alaska I	3,969	2,842	164	6,975	15.1
	Alaska II	5,934	10,826	395	17,155	37.5
	Nass/Skeena	7,127	9,073	243	16,443	35.9
	Tahltan	114	0	177	291	0.6
	Stikine	449	1,084	3,394	4,927	10.8
	Total	17,593	23,825	4,373	45,791	
7/16-7/22 Week 29	Alaska I	2,437	11,272	91	13,800	31.3
	Alaska II	13,160	5,340	178	18,678	42.2
	Nass/Skeena	4,173	3,958	105	8,236	18.7
	Tahltan	0	0	34	34	0.1
	Stikine	130	105	3,133	3,368	7.6
	Total	19,900	20,675	3,541	44,116	
7/23-7/29 Week 30	Alaska I	3,754	3,345	50	7,149	19.7
	Alaska II	9,288	9,052	229	18,569	51.2
	Nass/Skeena	5,559	3,361	99	9,019	24.9
	Tahltan	0	0	19	19	0.1
	Stikine	151	61	1,325	1,537	4.2
	Total	18,752	15,819	1,722	36,293	
7/30-8/05 Week 31	Alaska I	1,642	9,153		10,795	37.4
	Alaska II	5,226	3,007		8,233	28.5
	Nass/Skeena	3,981	5,507		9,488	32.8
	Tahltan	0	0		0	0.0
	Stikine	125	272		397	1.4
	Total	10,974	17,939		28,913	
8/06-8/12 Week 32	Alaska I	942	575		1,517	14.3
	Alaska II	3,478	2,073		5,551	52.4
	Nass/Skeena	2,098	1,325		3,423	32.3
	Tahltan	0	0		0	0.0
	Stikine	49	45		94	0.9
	Total	6,567	4,018		10,585	
8/13-9/23 Wks 33-38	Alaska I	1,004	1,007		2,011	17.0
	Alaska II	1,849	2,249		4,098	34.7
	Nass/Skeena	2,704	2,874		5,578	47.2
	Tahltan	0	0		0	0.0
	Stikine	43	76		119	1.0
	Total	5,600	6,206		11,806	
Season Totals	Alaska I	15,756	33,901	351	50,008	24.7
	Alaska II	40,410	36,537	832	77,779	38.3
	Nass/Skeena	27,297	32,661	544	60,502	29.8
	Tahltan	154	957	340	1,451	0.7
	Stikine	1,231	3,830	8,016	13,077	6.4
	Total	84,848	107,886	10,083	202,817	

[a] Percents may not sum to 1.0 due to rounding
[b] Weeks 25 and 26 were combined

Table 3. Mean classification accuracies from linear discriminant functions used postseasonally to classify sockeye salmon catches from Alaskan District 106 and 108, 1989.

					Age Class			
Stock Groups					1.2	1.3	2.2	2.3
5 Stocks								
Alaska I	Alaska II	Nass/Skeena	Tahltan	Stikine		0.607		
4 Stocks								
Alaska I	Alaska II	Nass/Skeena	Tahltan			0.652		
Alaska I	Alaska II	Nass/Skeena		Stikine		0.620		
Alaska I	Alaska II		Tahltan	Stikine		0.663		
Alaska I		Nass/Skeena	Tahltan	Stikine	0.673	0.696		0.641
		Nass/Skeena	Tahltan	Stikine		0.703		
3 Stocks								
Alaska I	Alaska II	Nass/Skeena				0.681		
Alaska I		Nass/Skeena	Tahltan		0.758	0.755		0.726
Alaska I		Nass/Skeena		Stikine	0.722	0.756		0.684
	Alaska II	Nass/Skeena	Tahltan			0.801		
	Alaska II	Nass/Skeena		Stikine		0.769		
2 Stocks								
Alaska I		Nass/Skeena			0.887	0.868	0.854	0.789
	Alaska II	Nass/Skeena				0.903		

Table 4. Log-likelihood (G) ratio test for differences in weekly inseason and postseason stock composition estimates for sockeye catches in Alaskan Districts 106 and 108, 1989. ho: Inseason and postseason estimates are the same α =.05

Week	Dates	df	G	P
Subdistrict 106-30				
25	6/18-6/24	4	84.3	<0.001
26	6/25-7/01	4	108.2	<0.001
27	7/02-7/08	4	142.7	<0.001
28	7/09-7/15	4	81.6	<0.001
29	7/16-7/22	4	193.0	<0.001
30	7/23-7/29	4	83.1	<0.001
Total		20	692.9	<0.001
Pooled		4	598.2	<0.001
Heterogeneity		16	94.6	<0.001
Subdistrict 106-41				
25	6/18-6/24	4	125.2	<0.001
26	6/25-7/01	4	64.0	<0.001
27	7/02-7/08	4	80.4	<0.001
28	7/09-7/15	4	132.0	<0.001
29	7/16-7/22	4	36.2	<0.001
30	7/23-7/29	4	82.0	<0.001
31	7/30-8/05	4	35.0	<0.001
Total		28	554.6	<0.001
Pooled		4	474.4	<0.001
Heterogeneity		24	80.2	<0.001
District 108				
25-26	6/18-7/01	4	95.7	<0.001
27	7/02-7/08	Fishery not Open		
28	7/09-7/15	4	26.9	<0.001
29	7/16-7/22	4	50.8	<0.001
30	7/23-7/29	4	35.5	<0.001
Total		16	208.8	<0.001
Pooled		4	191.6	<0.001
Heterogeneity		12	17.2	0.100<P<0.250

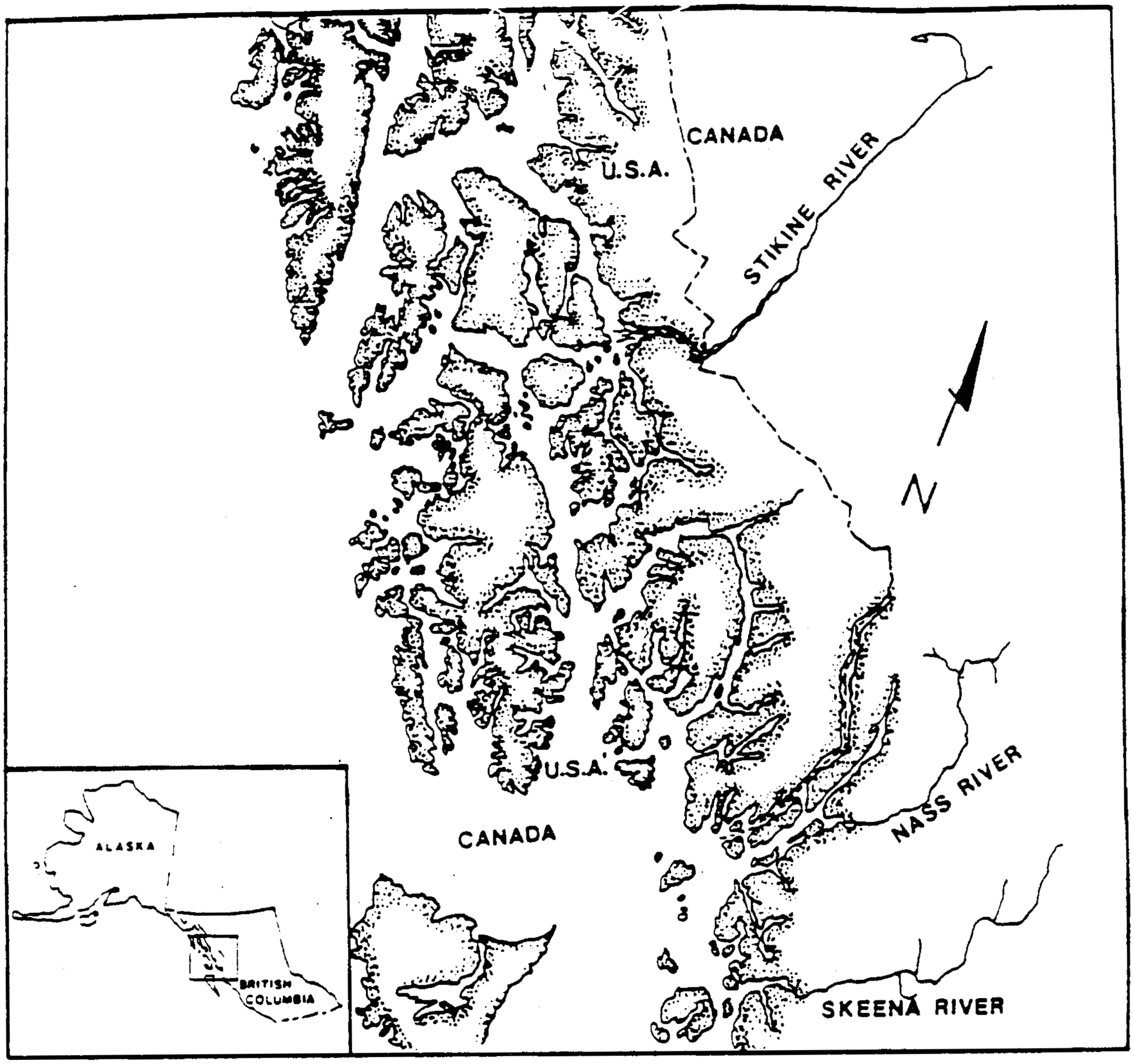

Figure 1. Southeast Alaska, northern British Columbia, and the transboundary Stikine River.

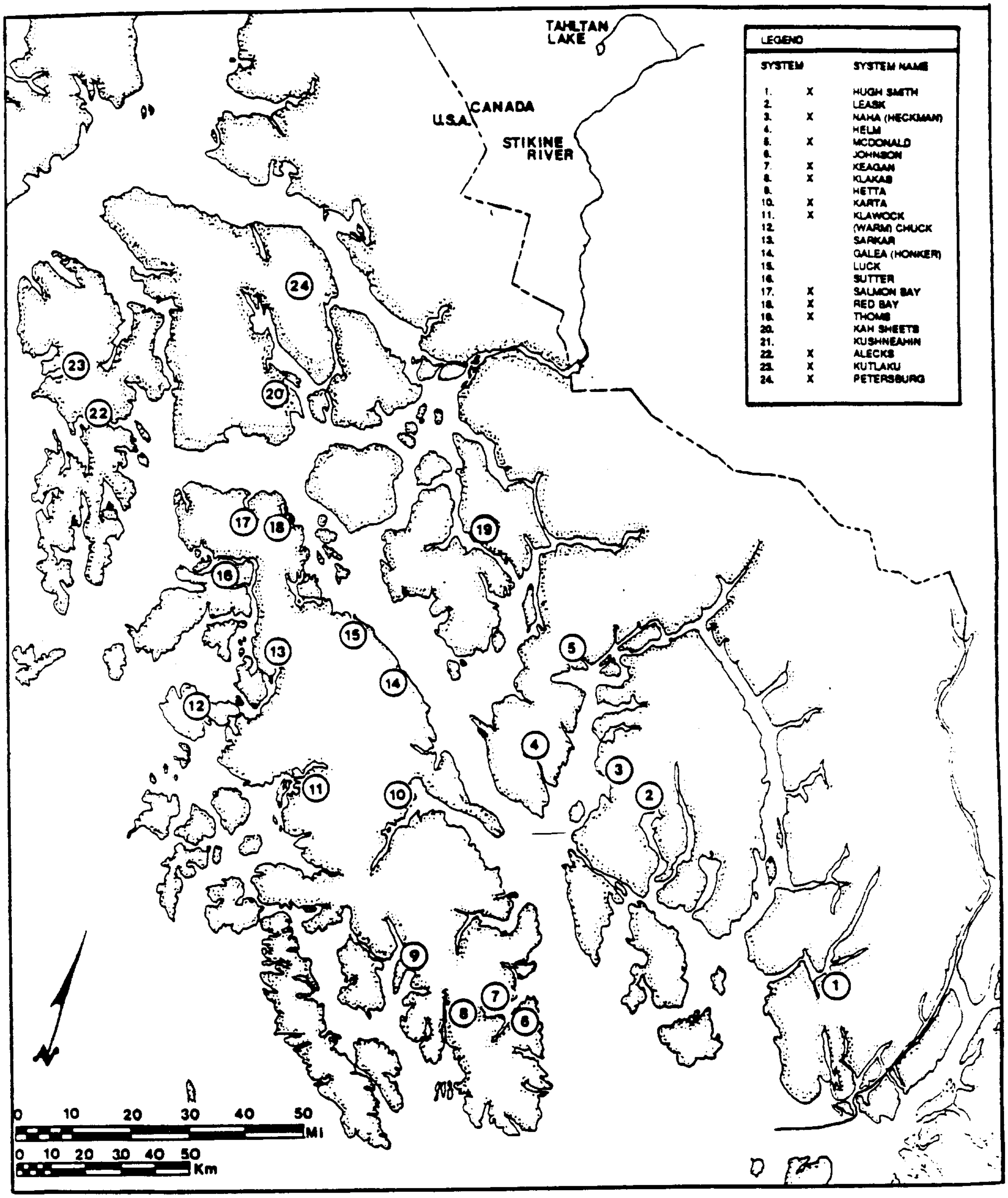

Figure 2. Major sockeye salmon systems of Southeast Alaska. Numbers identify lakes where scale samples have been collected and x indicates systems where scales were collected in 1989.

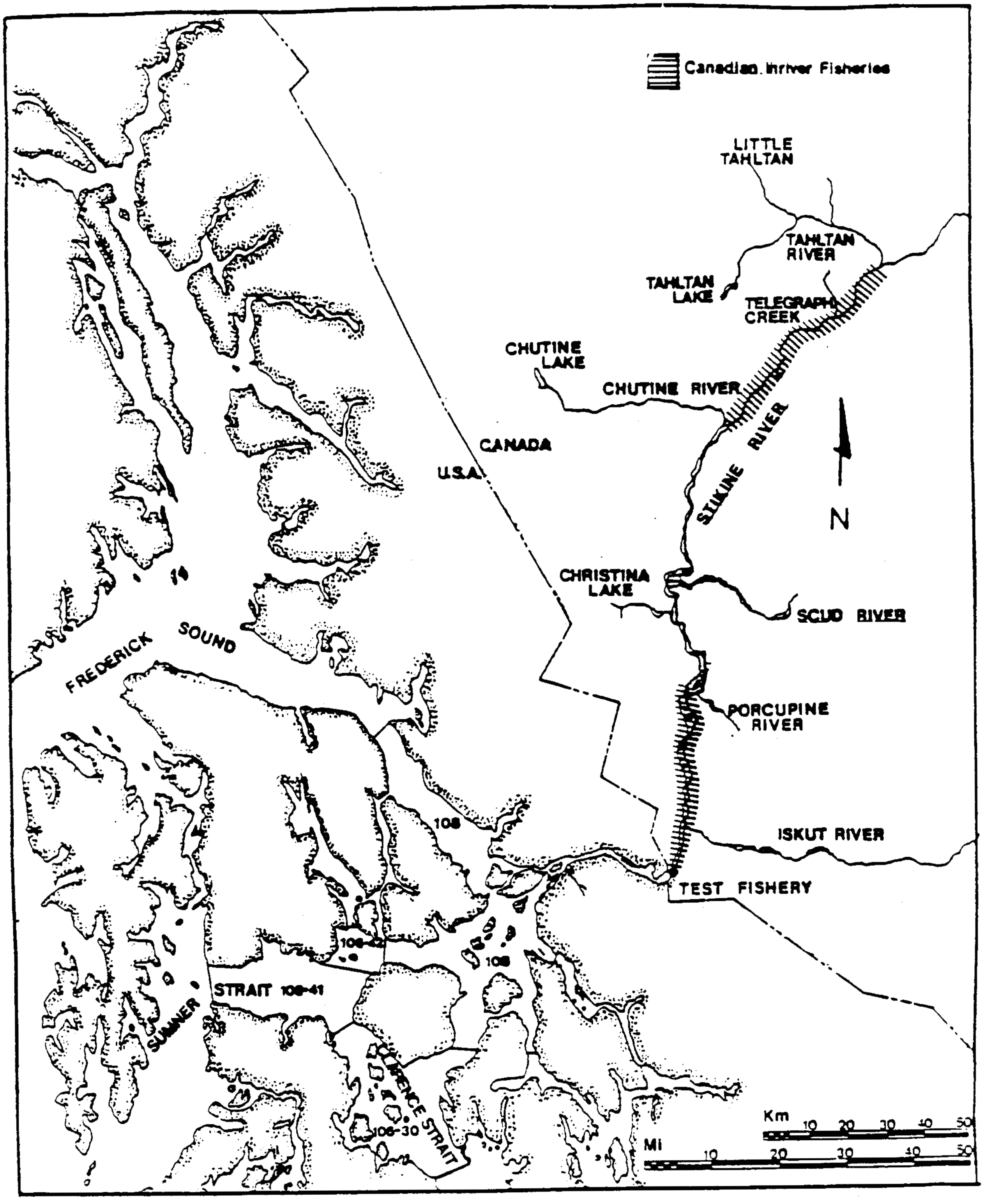

Figure 3. The transboundary Stikine River, major tributaries, and fishery areas.

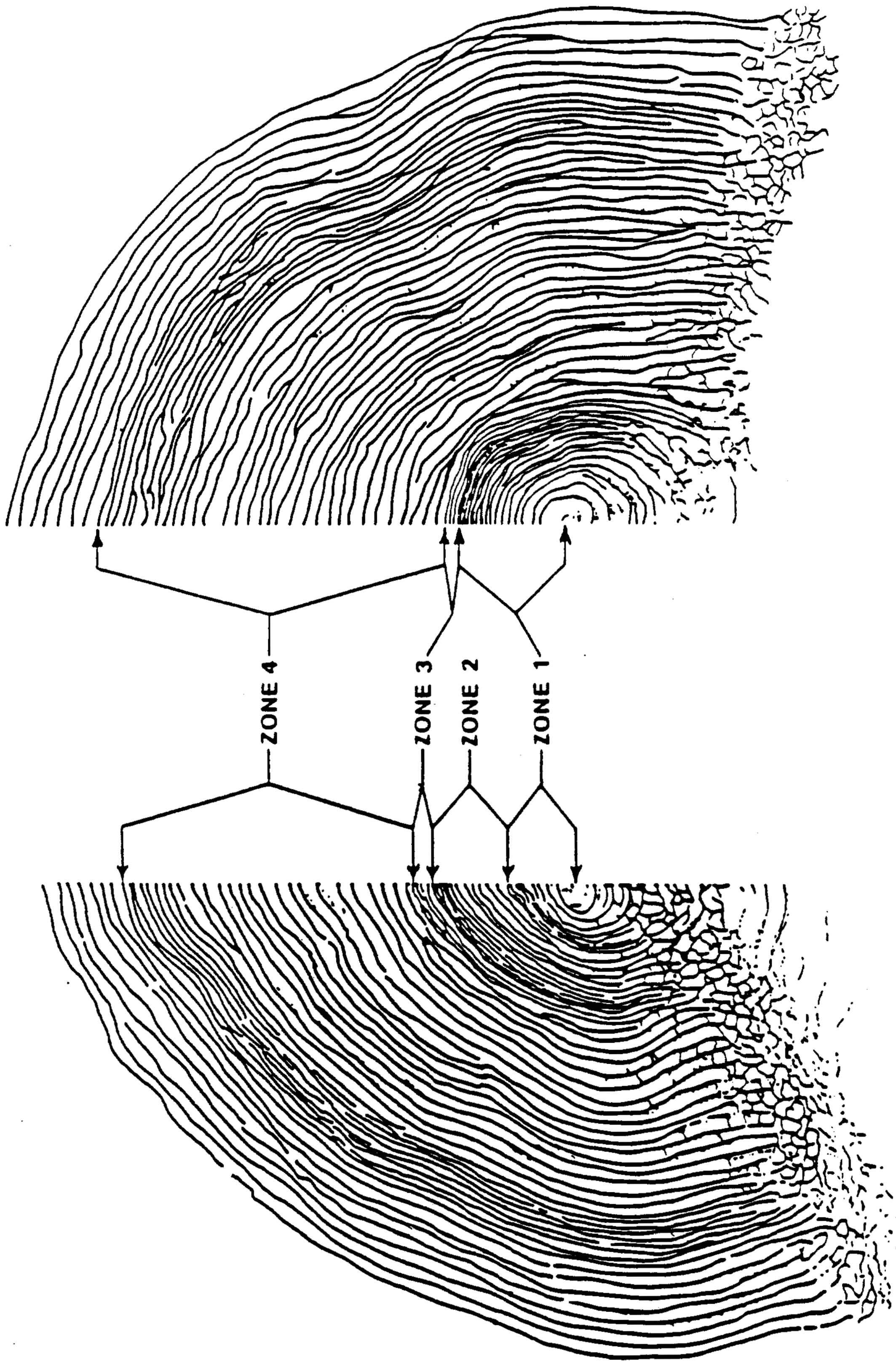

Figure 4. Typical scale for age-2. and -1. sockeye salmon with zones used for scale pattern analysis delineated.

APPENDIX

Appendix A.1. Sample sizes from sockeye salmon stock composition analysis of Alaskan District 106 and 108 gillnet catches, 1989. Catch samples for some age classes in some weeks were pooled prior to analysis and are listed at the end of the pooled period.

Stat. Week	Date	In-season Age-1.3	Postseason Sample Size by Age Group 1.2	1.3	2.2	2.3	0.	Total
106-41								
25	6/18-6/24	100		100	22			122
26	6/25-7/01	100		100	20			120
27	7/02-7/08	100	77	100	20	78		275
28	7/09-7/15	100		100				100
29	7/16-7-22	100	44	100	37	34		215
30	7/23-7/29	100		100				100
31	7/30-8/05	100	48	100	29	66		243
32	8/06-8/12	100		100				100
33	8/13-8/19							
34	8/20-8/26		86	144	48	102		380
Totals		700	169	700	128	178		1,175
106-30								
25	6/18-6/24	100		100	37			137
26	6/25-7/01	100		100	28	76		204
27	7/02-7/08	100	80	100	23			203
28	7/09-7/15	100		100		51		151
29	7/16-7-22	100	36	100	36			172
30	7/23-7/29	100		100	22	50		172
31	7/30-8/05	100	43	100	19			162
32	8/06-8/12	100		100	27	71		198
33	8/13-8/19							
34	8/20-8/26		68	128	34	58		288
Totals		700	159	700	165	177		1,201
108								
25	6/18-6/24	100						
26	6/25-7/01			116			30	146
27	7/02-7/08	-----Not Open-----						
28	7/09-7/15	100		100			79	179
29	7/16-7-22	100		100			66	166
30	7/23-7/29	100						
31	7/30-8/05		59	112	22	37	59	289
Totals		400	59	428	22	37	234	780

Appendix A.2. Scale variables used for age-1.2, -1.3, -2.2, and -2.3 sockeye salmon scale pattern analysis.

Variable Number	Description
	First Freshwater (FW) Annular Zone
1	Number of circuli in the zone
2	Distance across the zone
3	Distance: scale focus (CO) to the second circulus in zone (C2)
4	Distance: C0 to C4
5	Distance: C0 to C6
6	Distance: C0 to C8
7	Distance: C2 to C4
8	Distance: C2 to C6
9	Distance: C2 to C8
10	Distance: C4 to C6
11	Distance: C4 to C8
12	Distance: fourth from the last circulus of zone to end of zone
13	Distance: second from the last circulus of zone to end of zone
14	Distance: C2 to end of zone
15	Distance: C4 to end of zone
16	Relative Distance: (Variable #3)/(Variable #2)
17	Relative Distance: (Variable #4)/(Variable #2)
18	Relative Distance: (Variable #5)/(Variable #2)
19	Relative Distance: (Variable #6)/(Variable #2)
20	Relative Distance: (Variable #7)/(Variable #2)
21	Relative Distance: (Variable #8)/(Variable #2)
22	Relative Distance: (Variable #9)/(Variable #2)
23	Relative Distance: (Variable #10)/(Variable #2)
24	Relative Distance: (Variable #11)/(Variable #2)
25	Relative Distance: (Variable #12)/(Variable #2)
26	Relative Distance: (Variable #13)/(Variable #2)
27	Average Distance between circuli: (Variable #2)/(Variable #1)
28	Number of circuli in the first 3/4 of the zone
29	Maximum distance between two adjacent circuli in the zone
30	Relative Distance: (Variable #29)/(Variable #2)
	Second Freshwater (FW) Annular Zone
31	Number of circuli in the zone
32	Distance across the zone
33	Distance: end first annular zone (E1FW) to second circulus in zone
34	Distance: E1FW to C4
35	Distance: E1FW to C6
36	Distance: E1FW to C8
37	Distance: C2 to C4
38	Distance: C2 to C6
39	Distance: C2 to C8

-Continued-

Variable Number	Description
40	Distance: C4 to C6
41	Distance: C4 to C8
42	Distance: fourth from the last circulus of zone to end of zone
43	Distance: second from the last circulus of zone to end of zone
44	Distance: C2 to end of zone
45	Distance: C4 to end of zone
46	Relative Distance: Variable #33/Variable #32
47	Relative Distance: Variable #34/Variable #32
48	Relative Distance: Variable #35/Variable #32
49	Relative Distance: Variable #36/Variable #32
50	Relative Distance: Variable #37/Variable #32
51	Relative Distance: Variable #38/Variable #32
52	Relative Distance: Variable #39/Variable #32
53	Relative Distance: Variable #40/Variable #32
54	Relative Distance: Variable #41/Variable #32
55	Relative Distance: Variable #42/Variable #32
56	Relative Distance: Variable #43/Variable #32
57	Average Distance between circuli: Variable 32/Variable 31
58	Number of circuli in first 3/4 of zone
59	Maximum distance between two adjacent circuli in the zone
60	Relative Distance: Variable 59/Variable 32
	<u>Freshwater Plus Growth (PG)</u>
61	Number of circuli in the zone
62	Distance across the zone
	<u>Combined Freshwater Zones</u>
63	Total number annular circuli, Variable 1 + Variable 31
64	Total distance across freshwater zones, Variable 2 + Variable 32
65	Total number of circuli in the combined zones, NC1FW+NC2FW+NCPG
66	Total distance across the combined zones, S1FW+S2FW+SPGZ
67	Relative Distance: (Variable #2)/(Variable #66)
	<u>First Marine (C) Annular Zone</u>
70	Number of circuli in the zone
71	Distance across the zone
72	Distance: end of FW (EFW) to the third circulus in zone (C3)
73	Distance: EFW to C6
74	Distance: EFW to C9
75	Distance: EFW to C12
76	Distance: EFW to C15

-Continued-

Variable Number	Description
77	Distance: C3 to C6
78	Distance: C3 to C9
79	Distance: C3 to C12
80	Distance: C3 to C15
81	Distance: C6 to C9
82	Distance: C6 to C12
83	Distance: C6 to C15
84	Distance: C9 to C15
85	Distance: sixth from the last circulus of zone to end of zone
86	Distance: third from the last circulus of zone to end of zone
87	Distance: C3 to end of zone
88	Distance: C9 to end of zone
89	Distance: C15 to end of zone
90	Relative Distance: (Variable #72)/(Variable #71)
91	Relative Distance: (Variable #73)/(Variable #71)
92	Relative Distance: (Variable #74)/(Variable #71)
93	Relative Distance: (Variable #75)/(Variable #71)
94	Relative Distance: (Variable #76)/(Variable #71)
95	Relative Distance: (Variable #77)/(Variable #71)
96	Relative Distance: (Variable #78)/(Variable #71)
97	Relative Distance: (Variable #79)/(Variable #71)
98	Relative Distance: (Variable #80)/(Variable #71)
99	Relative Distance: (Variable #81)/(Variable #71)
100	Relative Distance: (Variable #82)/(Variable #71)
101	Relative Distance: (Variable #83)/(Variable #71)
102	Relative Distance: (Variable #84)/(Variable #71)
103	Relative Distance: (Variable #85)/(Variable #71)
104	Relative Distance: (Variable #86)/(Variable #71)
105	Relative Distance: (Variable #87)/(Variable #71)
106	Number of circuli in the first 1/2 of the zone
107	Maximum distance between two adjacent circuli in the zone
108	Relative Distance: (Variable #107)/(Variable #71)

Appendix B.1. Classification matrices for linear discriminant functions used to classify age-1.2 sockeye salmon caught in Alaskan District 106 and 108 gillnet fisheries, 1989. * Indicate functions used in final run; others, if present, were used only for intermediate steps.

Actual Group of Origin	Sample Size	Classified Group of Origin					Mean Accuracy
		Ak. I	Ak. II	Nas/Ske	Tahltan	Stikine	
4 Stock Function							
Alaska I	221	0.683		0.086	0.090	0.140	*
Nass/Skeena	200	0.080		0.735	0.140	0.045	
Tahltan	148	0.068		0.189	0.736	0.007	
Stikine	65	0.169		0.108	0.185	0.538	0.673
3 Stock Functions							
Alaska I	221	0.787		0.077	0.136		*
Nass/Skeena	200	0.100		0.770	0.130		
Tahltan	148	0.095		0.189	0.716		0.758
Alaska I	221	0.701		0.081		0.217	*
Nass/Skeena	200	0.075		0.835		0.090	
Stikine	65	0.200		0.169		0.631	0.722
2 Stock Function							
Alaska I	221	0.873		0.127			*
Nass/Skeena	200	0.100		0.900			0.887

Appendix B.2. Classification matrices for linear discriminant functions used to classify age-1.3 sockeye salmon caught in Alaskan District 106 and 108 gillnet fisheries, 1989. * Indicate functions used in final run; others, if present, were used only for intermediate steps.

Actual Group of Origin	Sample Size	Classified Group of Origin					Mean Accuracy
		Ak. I	Ak. II	Nas/Ske	Tahltan	Stikine	
5 Stock Functions							
Alaska I	202	0.505	0.272	0.059	0.074	0.089	*
Alaska II	208	0.280	0.546	0.019	0.024	0.130	
Nass/Skeena	200	0.035	0.095	0.595	0.180	0.095	
Tahltan	212	0.019	0.005	0.198	0.726	0.052	
Stikine	300	0.110	0.150	0.047	0.030	0.663	0.607
4 Stock Functions							
Alaska I	202	0.564	0.272	0.069	0.094		
Alaska II	207	0.295	0.652	0.014	0.039		
Nass/Skeena	200	0.050	0.125	0.610	0.215		
Tahltan	212	0.028	0.014	0.175	0.783		0.652
Alaska I	202	0.535	0.257	0.069		0.139	*
Alaska II	207	0.304	0.541	0.034		0.121	
Nass/Skeena	200	0.080	0.075	0.720		0.125	
Stikine	300	0.093	0.150	0.073		0.683	0.620
Alaska I	202	0.505	0.267		0.099	0.129	
Alaska II	207	0.275	0.556		0.014	0.155	
Tahltan	212	0.028	0.019		0.887	0.066	
Stikine	300	0.077	0.160		0.057	0.707	0.663
Alaska I	202	0.738		0.074	0.059	0.129	
Nass/Skeena	200	0.105		0.605	0.170	0.120	
Tahltan	212	0.033		0.170	0.745	0.052	
Stikine	300	0.207		0.043	0.053	0.697	0.696
Alaska II	207		0.797	0.024	0.043	0.135	*
Nass/Skeena	200		0.105	0.600	0.210	0.085	
Tahltan	212		0.028	0.228	0.698	0.047	
Stikine	300		0.207	0.043	0.033	0.717	0.703
3 Stock Functions							
Alaska I	202	0.619	0.277	0.104			*
Alaska II	207	0.343	0.633	0.024			
Nass/Skeena	200	0.090	0.120	0.790			0.681
Alaska I	202	0.797		0.119	0.084		
Nass/Skeena	200	0.105		0.685	0.210		
Tahltan	212	0.033		0.184	0.783		0.755
Alaska I	202	0.782		0.074		0.144	
Nass/Skeena	200	0.145		0.735		0.120	
Stikine	300	0.197		0.053		0.750	0.756
Alaska II	207		0.918	0.048	0.034		
Nass/Skeena	200		0.110	0.680	0.210		
Tahltan	212		0.019	0.175	0.807		0.801
Alaska II	207		0.816	0.024		0.159	*
Nass/Skeena	200		0.130	0.780		0.090	
Stikine	300		0.217	0.073		0.710	0.769
2 Stock Functions							
Alaska I	202	0.861		0.139			*
Nass/Skeena	200	0.130		0.870			0.868
Alaska II	207		0.976	0.024			*
Nass/Skeena	200		0.170	0.830			0.903

Appendix B.3. Classification matrices for linear discriminant functions used to classify age-2.2 sockeye salmon caught in Alaskan District 106 and 108 gillnet fisheries, 1989. * Indicate functions used in final run; others, if present, were used only for intermediate steps.

Actual Group of Origin	Sample Size	Classified Group of Origin					Mean Accuracy
		Ak. I	Ak. II	Nas/Ske	Tahltan	Stikine	
2 Stock Function							
Alaska I	217	0.839		0.161			*
Nass/Skeena	169	0.130		0.870			0.854

Appendix B.4. Classification matrices for linear discriminant functions used to classify age-2.3 sockeye salmon caught in Alaskan District 106 and 108 gillnet fisheries, 1989. * Indicate functions used in final run; others, if present, were used only for intermediate steps.

Actual Group of Origin	Sample Size	Classified Group of Origin: Ak. I	Ak. II	Nas/Ske	Tahltan	Stikine	Mean Accuracy
4 Stock Function							
Alaska I	231	0.658		0.147	0.074	0.121	*
Nass/Skeena	135	0.156		0.563	0.111	0.170	
Tahltan	57	0.018		0.175	0.754	0.053	
Stikine	51	0.137		0.118	0.157	0.588	0.641
3 Stock Functions							
Alaska I	231	0.727		0.169	0.104		*
Nass/Skeena	135	0.193		0.644	0.163		
Tahltan	57	0.035		0.158	0.807		0.726
Alaska I	231	0.641		0.177		0.182	*
Nass/Skeena	135	0.170		0.667		0.163	
Stikine	51	0.137		0.118		0.745	0.684
2 Stock Function							
Alaska I	231	0.792		0.208			*
Nass/Skeena	135	0.215		0.785			0.789

Appendix C.1. Estimated contributions of sockeye salmon stocks originating in Alaska and Canada to the Alaskan Subdistrict 106-30 drift gillnet fishery, 1989.

		Catch By Age Class								90% C.I.[a]	
Dates	Stock Group	1.2	1.3	2.2	2.3	Other	Total	Percent	Standard Error[a]	Lower	Upper
6/18-6/24	Alaska I	38	392	47	102	24	603	50.7	136.3	379	827
Week 25	Alaska II	0	168	0	0	7	175	14.7	567.2	0	1,108
	Nass/Skeena	9	167	88	66	14	344	29.0	67.9	232	456
	Tahltan	0	26	0	0	1	27	2.3	44.5	0	100
	Stikine	37	0	0	0	2	39	3.3	13.8	16	62
	Total	84	753	135	168	48	1,188				
6/25-7/01	Alaska I	87	487	46	122	14	756	42.6	192.4	440	1,072
Week 26	Alaska II	0	380	0	0	6	386	21.8	748.7	0	1,618
	Nass/Skeena	21	313	124	78	9	545	30.7	92.0	394	696
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	86	0	0	0	1	87	4.9	40.7	20	154
	Total	194	1,180	170	200	30	1,774				
7/02-7/08	Alaska I	106	229	80	229	5	649	26.0	270.5	204	1,094
Week 27	Alaska II	0	908	0	0	6	914	36.6	756.2	0	2,158
	Nass/Skeena	25	535	138	62	6	766	30.6	129.5	553	979
	Tahltan	0	0	0	13	0	13	0.5	26.5	0	57
	Stikine	104	0	0	53	1	158	6.3	45.8	83	233
	Total	235	1,672	218	357	18	2,500				
7/09-7/15	Alaska I	724	1,989	418	824	14	3,969	22.6	2128.4	468	7,470
Week 28	Alaska II	0	5,913	0	0	21	5,934	33.7	1557.9	3,371	8,497
	Nass/Skeena	600	5,416	865	222	24	7,127	40.5	1323.8	4,949	9,305
	Tahltan	0	67	0	47	0	114	0.6	804.7	0	1,438
	Stikine	203	54	0	190	2	449	2.6	863.5	0	1,869
	Total	1,527	13,439	1,283	1,283	61	17,593				
7/16-7/22	Alaska I	465	0	297	1,675	0	2,437	12.2	612.9	1,429	3,445
Week 29	Alaska II	0	13,160	0	0	0	13,160	66.1	2478.0	9,084	17,236
	Nass/Skeena	386	2,676	614	497	0	4,173	21.0	891.0	2,707	5,639
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	130	0	0	0	0	130	0.7	391.9	0	775
	Total	981	15,836	911	2,172	0	19,900				
7/23-7/29	Alaska I	501	1,713	420	1,109	11	3,754	20.0	2411.5	0	7,721
Week 30	Alaska II	0	9,260	0	0	28	9,288	49.6	1944.3	6,090	12,486
	Nass/Skeena	565	3,796	853	329	16	5,559	29.6	1022.5	3,877	7,241
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	151	0	0	0	0	151	0.8	171.5	0	433
	Total	1,217	14,769	1,273	1,438	55	18,752				
7/30-8/05	Alaska I	414	0	361	867	0	1,642	15.0	396.9	989	2,295
Week 31	Alaska II	0	5,226	0	0	0	5,226	47.6	2112.0	1,752	8,700
	Nass/Skeena	465	2,438	383	695	0	3,981	36.3	544.9	3,085	4,877
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	125	0	0	0	0	125	1.1	308.6	0	633
	Total	1,004	7,664	744	1,562	0	10,974				
8/06-8/12	Alaska I	258	0	190	480	14	942	14.3	301.7	446	1,438
Week 32	Alaska II	0	3,430	0	0	48	3,478	53.1	154.2	3,224	3,732
	Nass/Skeena	515	697	471	386	29	2,098	31.9	357.2	1,510	2,686
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	48	0	0	0	1	49	0.7	84.8	0	188
	Total	821	4,127	661	866	92	6,567				
8/13-9/23	Alaska I	231	0	181	589	3	1,004	17.9	220.9	641	1,367
Wks 33-38	Alaska II	0	1,844	0	0	5	1,849	33.0	265.1	1,413	2,285
	Nass/Skeena	462	1,420	395	419	8	2,704	48.3	305.1	2,202	3,206
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	43	0	0	0	0	43	0.8	156.5	0	300
	Total	736	3,264	576	1,008	16	5,600				
	Alaska I	2,824	4,810	2,040	5,997	85	15,756	18.6	3306.3	10,317	21,195
	Alaska II	0	40,289	0	0	121	40,410	47.5	4284.4	33,362	47,458
Season	Nass/Skeena	3,048	17,458	3,931	2,754	106	27,297	32.2	1990.1	24,023	30,571
Totals	Tahltan	0	93	0	60	1	154	0.2	805.9	0	1,480
	Stikine	927	54	0	243	7	1,231	1.5	984.4	0	2,850
	Total	6,799	62,704	5,971	9,054	320	84,848				

[a] The standard errors are minimum estimates since no estimates of the variance for stocks contribution 0 fish during a given week or for the 'other' age class are available. The 90% confidence intervals are affected in like manner.

Appendix C.2. Estimated CPUE and migratory timing of sockeye salmon stocks in the Alaskan Subdistrict 106-30 drift gillnet fishery, 1989.

CPUE

Stat Week	Days Open	Average Number Boats	Catch per Boat Day AlaskaI	AlaskaII	Nass/ Skeena	Tahltan	Stikine	Total
25	2	20	15	4	9	1	1	30
26	2	28	14	7	10	0	2	32
27	2	25	13	18	15	0	3	50
28	3	37	36	53	64	1	4	158
29	3	43	19	102	32	0	1	154
30	3	86	15	36	22	0	1	73
31	3	63	9	28	21	0	1	58
32	3	55	6	21	13	0	0	40
33-38	13	41	2	3	5	0	0	10
Total			127	273	191	2	12	605

Migratory Timing

Stat Week	Proportion of Catch per Boat Day AlaskaI	AlaskaII	Nass/ Skeena	Tahltan	Stikine	Total
25	0.12	0.02	0.05	0.34	0.08	0.05
26	0.11	0.03	0.05	0.00	0.13	0.05
27	0.10	0.07	0.08	0.13	0.26	0.08
28	0.28	0.20	0.34	0.52	0.33	0.26
29	0.15	0.37	0.17	0.00	0.08	0.25
30	0.11	0.13	0.11	0.00	0.05	0.12
31	0.07	0.10	0.11	0.00	0.05	0.10
32	0.04	0.08	0.07	0.00	0.02	0.07
33-38	0.01	0.01	0.03	0.00	0.01	0.02
Total	1.00	1.00	1.00	1.00	1.00	1.00

Appendix C.3. Estimated contributions of sockeye salmon stocks originating in Alaska and Canada to the Alaskan Subdistrict 106-41,42 drift gillnet fishery, 1989.

Dates	Stock Group	Catch By Age Class 1.2	1.3	2.2	2.3	Other	Total	Percent	Standard Error[a]	90% C.I.[a] Lower	Upper
6/18-6/24	Alaska I	211	428	29	245	12	925	18.3	560.0	4	1,846
Week 25	Alaska II	0	1,523	0	0	21	1,544	30.6	567.2	611	2,477
	Nass/Skeena	138	1,482	374	91	29	2,114	41.9	365.9	1,512	2,716
	Tahltan	0	78	0	83	2	163	3.2	229.5	0	541
	Stikine	87	212	0	0	4	303	6.0	246.3	0	708
	Total	436	3,723	403	419	68	5,049				
6/25-7/01	Alaska I	299	1,881	120	278	45	2,623	37.7	826.3	1,264	3,982
Week 26	Alaska II	0	927	0	0	16	943	13.6	748.7	0	2,175
	Nass/Skeena	196	1,383	380	103	36	2,098	30.2	491.1	1,290	2,906
	Tahltan	0	487	0	95	10	592	8.5	352.9	11	1,173
	Stikine	124	561	0	0	12	697	10.0	366.2	95	1,299
	Total	619	5,239	500	476	119	6,953				
7/02-7/08	Alaska I	360	1,142	144	478	35	2,159	29.2	833.4	788	3,530
Week 27	Alaska II	0	1,479	0	0	24	1,503	20.3	756.2	259	2,747
	Nass/Skeena	236	1,443	457	176	39	2,351	31.8	386.2	1,716	2,986
	Tahltan	0	36	0	163	3	202	2.7	308.6	0	710
	Stikine	149	1,019	0	0	19	1,187	16.0	433.1	475	1,899
	Total	745	5,119	601	817	120	7,402				
7/09-7/15	Alaska I	725	0	810	1,240	67	2,842	11.9	1604.6	202	5,482
Week 28	Alaska II	0	10,571	0	0	255	10,826	45.5	1557.9	8,263	13,389
	Nass/Skeena	965	6,882	800	211	215	9,073	38.1	1241.3	7,031	11,115
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	0	899	0	159	26	1,084	4.5	1313.4	0	3,245
	Total	1,690	18,352	1,610	1,610	563	23,825				
7/16-7/22	Alaska I	754	9,092	581	820	25	11,272	54.6	2856.5	6,573	15,971
Week 29	Alaska II	0	5,328	0	0	12	5,340	25.8	2478.0	1,264	9,416
	Nass/Skeena	1,004	2,231	575	139	9	3,958	19.1	1151.2	2,064	5,852
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	0	0	0	105	0	105	0.5	357.5	0	693
	Total	1,758	16,651	1,156	1,064	46	20,675				
7/23-7/29	Alaska I	288	1,022	610	1,425	0	3,345	21.1	2095.4	0	6,792
Week 30	Alaska II	0	9,052	0	0	0	9,052	57.3	1944.3	5,854	12,250
	Nass/Skeena	588	2,241	163	369	0	3,361	21.2	720.7	2,175	4,547
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	0	0	0	61	0	61	0.4	173.9	0	347
	Total	876	12,315	773	1,855	0	15,819				
7/30-8/05	Alaska I	642	6,324	747	1,411	29	9,153	51.0	2406.4	5,194	13,112
Week 31	Alaska II	0	2,998	0	0	9	3,007	16.8	2112.0	0	6,481
	Nass/Skeena	1,308	3,616	200	366	17	5,507	30.7	1058.2	3,766	7,248
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	0	210	0	61	1	272	1.5	956.9	0	1,846
	Total	1,950	13,148	947	1,838	56	17,939				
8/06-8/12	Alaska I	120	0	155	300	0	575	14.3	364.0	0	1,174
Week 32	Alaska II	0	2,073	0	0	0	2,073	51.6	353.3	1,492	2,654
	Nass/Skeena	367	499	203	256	0	1,325	33.0	167.1	1,050	1,600
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	0	0	0	45	0	45	1.1	316.7	0	566
	Total	487	2,572	358	601	0	4,018				
8/13-9/23	Alaska I	205	118	169	510	5	1,007	16.2	911.8	0	2,507
Wks 33-38	Alaska II	0	2,237	0	0	12	2,249	36.2	265.1	1,813	2,685
	Nass/Skeena	624	1,577	220	438	15	2,874	46.4	326.9	2,336	3,412
	Tahltan	0	0	0	0	0	0	0.0			
	Stikine	0	0	0	76	0	76	1.2	128.3	0	287
	Total	829	3,932	389	1,024	32	6,206				
	Alaska I	3,604	20,007	3,365	6,707	218	33,901	31.4	4814.2	25,982	41,820
	Alaska II	0	36,188	0	0	349	36,537	33.8	4284.4	29,489	43,585
Season	Nass/Skeena	5,426	21,354	3,372	2,149	360	32,661	30.3	2223.1	29,004	36,318
Totals	Tahltan	0	601	0	341	15	957	0.9	516.2	108	1,806
	Stikine	360	2,901	0	507	62	3,830	3.6	1762.1	931	6,729
	Total	9,390	81,051	6,737	9,704	1,004	107,886				

[a] The standard errors are minimum estimates since no estimates of the variance for stocks contribution 0 fish during a given week or for the 'other' age class are available. The 90% confidence intervals are affected in like manner.

Appendix C.4. Estimated CPUE and migratory timing of sockeye salmon stocks in the Alaskan Subdistrict 106-41,42 drift gillnet fishery, 1989.

CPUE

Stat Week	Days Open	Average Number Boats	Catch per Boat Day: AlaskaI	AlaskaII	Nass/ Skeena	Tahltan	Stikine	Total
25	2	54	9	14	20	2	3	6
26	2	67	20	7	16	4	5	52
27	2	56	19	13	21	2	11	66
28	3	54	18	67	56	0	7	147
29	3	63	60	28	21	0	1	109
30	3	59	19	51	19	0	0	89
31	3	64	48	16	29	0	1	93
32	3	37	5	19	12	0	0	36
33-38	13	37	2	5	6	0	0	13
Total			198	220	199	8	28	613

Migratory Timing

Stat Week	Proportion of Catch per Boat Day: AlaskaI	AlaskaII	Nass/ Skeena	Tahltan	Stikine	Total
25	0.04	0.06	0.10	0.20	0.10	0.01
26	0.10	0.03	0.08	0.57	0.18	0.08
27	0.10	0.06	0.11	0.23	0.38	0.11
28	0.09	0.30	0.28	0.00	0.24	0.24
29	0.30	0.13	0.11	0.00	0.02	0.18
30	0.10	0.23	0.10	0.00	0.01	0.15
31	0.24	0.07	0.14	0.00	0.05	0.15
32	0.03	0.08	0.06	0.00	0.01	0.06
33-38	0.01	0.02	0.03	0.00	0.01	0.02
Total	1.00	1.00	1.00	1.00	1.00	1.00

Appendix C.5. Estimated contributions of sockeye salmon stocks originating in Alaska and Canada to Alaskan District 108 drift gillnet fishery, 1989.

		Catch By Age Class								Standard	90% C.I.[a]	
Dates	Stock Group	1.2	1.3	2.2	2.3	0.+	Other	Total	Percent	Error[a]	Lower	Upper
6/18-7/01	Alaska I	10	22	9	5	0	0	46	10.3	29.5	0	95
Wks 25-26	Alaska II	0	30	0	0	0	0	30	6.7	29.0	0	78
	Nass/Skeena	4	71	14	8	0	0	97	21.7	28.5	50	144
	Tahltan	5	104	0	1	0	0	110	24.6	24.7	69	151
	Stikine	8	72	0	16	68	0	164	36.7	21.9	128	200
	Total	27	299	23	30	68	0	447				
7/02-7/08 Week 27	Fishery Not Open											
7/09-7/15	Alaska I	106	0	33	25	0	0	164	3.8	55.7	72	256
Week 28	Alaska II	0	395	0	0	0	0	395	9.0	222.9	28	762
	Nass/Skeena	43	108	49	43	0	0	243	5.6	164.0	0	513
	Tahltan	50	119	0	8	0	0	177	4.0	137.5	0	403
	Stikine	99	2,140	0	86	1,069	0	3,394	77.6	266.5	2,956	3,832
	Total	298	2,762	82	162	1,069	0	4,373				
7/16-7/22	Alaska I	64	0	15	12	0	0	91	2.6	76.4	0	217
Week 29	Alaska II	0	178	0	0	0	0	178	5.0	198.3	0	504
	Nass/Skeena	26	36	23	20	0	0	105	3.0	126.1	0	312
	Tahltan	30	0	0	4	0	0	34	1.0	119.2	0	230
	Stikine	59	2,189	0	41	844	0	3,133	88.4	256.5	2,711	3,555
	Total	179	2,403	38	77	844	0	3,541				
7/23-7/29	Alaska I	26	0	18	6	0	0	50	2.9	86.5	0	192
Week 30	Alaska II	0	229	0	0	0	0	229	13.3	97.4	69	389
	Nass/Skeena	11	49	28	11	0	0	99	5.7	102.3	0	267
	Tahltan	12	5	0	2	0	0	19	1.1	81.3	0	153
	Stikine	25	941	0	21	338	0	1,325	77.0	146.1	1,085	1,565
	Total	74	1,224	46	40	338	0	1,722				
	Alaska I	206	22	75	48	0	0	351	3.5	96.6	192	510
	Alaska II	0	832	0	0	0	0	832	8.3	315.2	313	1,351
Season	Nass/Skeena	84	264	114	82	0	0	544	5.4	216.6	188	900
Totals	Tahltan	97	228	0	15	0	0	340	3.4	188.1	31	649
	Stikine	191	5,342	0	164	2,319	0	8,016	79.4	385.3	7,382	8,650
	Total	578	6,688	189	309	2,319	0	10,083				

[a] The standard errors are minimum estimates since no estimates of the variance for stocks contributing 0 fish during a given week or for the 'other' age class are available. The 90% confidence intervals are affected in like manner.

Appendix C.6. Estimated CPUE and migratory timing of sockeye salmon stocks in Alaskan District 108 drift gillnet fishery, 1989.

CPUE

Stat Week	Days Open	Average Number Boats	Catch per Boat Day AlaskaI	AlaskaII	Nass/ Skeena	Tahltan	Stikine	Total
25-26	4	9	1	1	3	3	5	12
27	Not Open							
28	3	7	8	19	12	8	162	208
29	3	12	3	5	3	1	87	98
30-36	19	8	0	2	1	0	9	12
Total			12	26	18	13	262	331

Migratory Timing

Stat Week	Proportion of Catch per Boat Day AlaskaI	AlaskaII	Nass/ Skeena	Tahltan	Stikine	Total
25-26	0.11	0.03	0.15	0.24	0.02	0.04
27	Not Open					
28	0.65	0.72	0.65	0.67	0.62	0.63
29	0.21	0.19	0.16	0.08	0.33	0.30
30-36	0.03	0.06	0.04	0.01	0.04	0.04
Total	1.00	1.00	1.00	1.00	1.00	1.00

Appendix C.7. Estimated contributions of sockeye salmon stocks originating in Alaska and Canada to Alaskan Subdistrict 106-30 gillnet test fishery, 1989.

		Catch By Age Class						
Dates	Stock Group	1.2	1.3	2.2	2.3	Other	Total	Percent
8/13-9/16	Alaska I	2	0	1	4	0	7	18.9
Wks 33-37	Alaska II	0	12	0	0	0	12	32.4
	Nass/Skeena	4	8	3	3	0	18	48.7
	Tahltan	0	0	0	0	0	0	0.0
	Stikine	0	0	0	0	0	0	0.0
	Total	6	20	4	7	0	37	
	Alaska I	2	0	1	4	0	7	18.9
	Alaska II	0	12	0	0	0	12	32.4
Season	Nass/Skeena	4	8	3	3	0	18	48.7
Totals	Tahltan	0	0	0	0	0	0	0.0
	Stikine	0	0	0	0	0	0	0.0
	Total	6	20	4	7	0	37	

Appendix C.8. Estimated contributions of sockeye salmon stocks originating in Alaska and Canada to Alaskan Subdistrict 106-41 gillnet test fishery, 1989.

Dates	Stock Group	Catch By Age Class 1.2	1.3	2.2	2.3	Other	Total	Percent
6/18-6/24	Alaska I	6	12	1	7	0	26	18.8
Week 25	Alaska II	0	41	0	0	1	42	30.4
	Nass/Skeena	4	41	10	2	1	58	42.1
	Tahltan	0	2	0	2	0	4	2.9
	Stikine	2	6	0	0	0	8	5.8
	Total	12	102	11	11	2	138	
6/25-7/01	Alaska I	11	71	5	10	2	99	37.8
Week 26	Alaska II	0	36	0	0	1	37	14.1
	Nass/Skeena	7	52	14	4	1	78	29.8
	Tahltan	0	18	0	4	0	22	8.4
	Stikine	5	21	0	0	0	26	9.9
	Total	23	198	19	18	4	262	
7/02-7/08	Alaska I	15	47	6	20	1	89	28.9
Week 27	Alaska II	0	63	0	0	1	64	20.8
	Nass/Skeena	10	60	19	7	2	98	31.8
	Tahltan	0	1	0	7	0	8	2.6
	Stikine	6	42	0	0	1	49	15.9
	Total	31	213	25	34	5	308	
7/09-7/15	Alaska I	19	0	21	32	2	74	12.2
Week 28	Alaska II	0	269	0	0	7	276	45.4
	Nass/Skeena	25	175	20	5	5	230	37.8
	Tahltan	0	0	0	0	0	0	0.0
	Stikine	0	23	0	4	1	28	4.6
	Total	44	467	41	41	15	608	
7/16-7/22	Alaska I	11	129	8	12	0	160	54.7
Week 29	Alaska II	0	76	0	0	0	76	25.9
	Nass/Skeena	14	32	8	2	0	56	19.1
	Tahltan	0	0	0	0	0	0	0.0
	Stikine	0	0	0	1	0	1	0.3
	Total	25	237	16	15	0	293	
7/23-7/29	Alaska I	6	22	13	30	0	71	21.0
Week 30	Alaska II	0	194	0	0	0	194	57.4
	Nass/Skeena	13	48	3	8	0	72	21.3
	Tahltan	0	0	0	0	0	0	0.0
	Stikine	0	0	0	1	0	1	0.3
	Total	19	264	16	39	0	338	
7/30-8/05	Alaska I	3	35	4	8	0	50	52.1
Week 31	Alaska II	0	16	0	0	0	16	16.7
	Nass/Skeena	7	19	1	2	0	29	30.2
	Tahltan	0	0	0	0	0	0	0.0
	Stikine	0	1	0	0	0	1	1.0
	Total	10	71	5	10	0	96	
	Alaska I	71	316	58	119	5	569	27.9
	Alaska II	0	695	0	0	10	705	34.5
Season	Nass/Skeena	80	427	75	30	9	621	30.3
Totals	Tahltan	0	21	0	13	0	34	1.7
	Stikine	13	93	0	6	2	114	5.6
	Total	164	1,552	133	168	26	2,043	

Appendix C.9. Estimated contributions of sockeye salmon stocks originating in Alaska and Canada to Alaskan District 108 gillnet test fishery, 1989.

		Catch By Age Class							
Dates	Stock Group	1.2	1.3	2.2	2.3	0.+	Other	Total	Percent
6/18-7/01	Alaska I	4	10	4	2	0	0	20	9.9
Wks 25-26	Alaska II	0	14	0	0	0	0	14	6.9
	Nass/Skeena	2	32	6	4	0	0	44	21.7
	Tahltan	2	48	0	1	0	0	51	25.1
	Stikine	4	32	0	7	31	0	74	36.4
	Total	12	136	10	14	31	0	203	
7/02-7/15	Alaska I	14	0	4	3	0	0	21	3.7
Wks 27-28	Alaska II	0	51	0	0	0	0	51	9.1
	Nass/Skeena	5	14	6	6	0	0	31	5.5
	Tahltan	6	15	0	1	0	0	22	3.9
	Stikine	13	276	0	11	137	0	437	77.8
	Total	38	356	10	21	137	0	562	
7/16-7/22	Alaska I	3	0	1	1	0	0	5	3.1
Week 29	Alaska II	0	8	0	0	0	0	8	4.9
	Nass/Skeena	1	2	1	1	0	0	5	3.1
	Tahltan	1	0	0	0	0	0	1	0.6
	Stikine	3	100	0	2	39	0	144	88.3
	Total	8	110	2	4	39	0	163	
7/23-8/05	Alaska I	2	0	1	0	0	0	3	2.7
Wks 30-31	Alaska II	0	15	0	0	0	0	15	13.6
	Nass/Skeena	1	3	2	1	0	0	7	6.4
	Tahltan	1	0	0	0	0	0	1	0.9
	Stikine	2	59	0	1	22	0	84	76.4
	Total	6	77	3	2	22	0	110	
	Alaska I	23	10	10	6	0	0	49	4.7
	Alaska II	0	88	0	0	0	0	88	8.5
Season	Nass/Skeena	9	51	15	12	0	0	87	8.4
Totals	Tahltan	10	63	0	2	0	0	75	7.2
	Stikine	22	467	0	21	229	0	739	71.2
	Total	64	679	25	41	229	0	1,038	

Appendix D.1. Estimated contributions of sockeye salmon stock groups to Alaskan District 106 gillnet fisheries, 1982-1989. Subdistrict 106-30 was open but 106-41 was not during weeks 25-28 in 1984, week 26 in 1985, and week 29 in 1986.

		Year and Date of Statistical Week 25 (June)							
Stat. Week	Stock Group	1982 13-19	1983 12-18	1984 17-23	1985 16-22	1986 15-21	1987 14-20	1988 12-18	1989 18-24
25[a]	Alaska I	4,126	not open	1,364	9,279	2,212	not open	not open	1,528
	Alaska II					27			1,719
	Nass/Skeena	2,897		201	1,477	351			2,458
	Tahltan	[b]		112	1,444	0			190
	Stikine	129		8	3	0			342
	Total	7,152		1,685	12,203	2,590			6,237
26	Alaska I	18,625	3,155	2,671	6,909	3,064	3,695	1,824	3,379
	Alaska II					60	931	210	1,329
	Nass/Skeena	11,806	1,587	562	1,789	503	322	74	2,643
	Tahltan		507	280	1,365	62	186	145	592
	Stikine	6,540	104	180	170	0	14	0	784
	Total	36,971	5,353	3,693	10,233	3,689	5,148	2,253	8,727
27	Alaska I	25,978	4,037	5,475	14,314	12,124	6,933	6,319	2,808
	Alaska II					610	2,042	1,108	2,417
	Nass/Skeena	13,240	1,647	1,078	6,003	3,050	1,354	601	3,117
	Tahltan		1,327	844	7,801	1,184	104	488	215
	Stikine	5,932	51	312	270	420	0	0	1,345
	Total	45,150	7,062	7,709	28,388	17,388	10,433	8,516	9,902
28	Alaska I	15,318	4,389	6,884	17,689	not open	10,553	5,902	6,811
	Alaska II						3,588	1,601	16,760
	Nass/Skeena	12,197	913	2,563	13,132		5,767	989	16,200
	Tahltan		736	1,134	6,288		780	296	114
	Stikine	9,900	44	50	492		57	0	1,533
	Total	37,415	6,082	10,631	37,601		20,745	8,788	41,418
29	Alaska I	9,110	3,411	13,314	21,025	6,086	15,641	11,435	13,709
	Alaska II					1,115	3,209	9,966	18,500
	Nass/Skeena	4,108	250	3,135	15,424	424	2,664	2,687	8,131
	Tahltan		355	307	7,152	2	192	630	0
	Stikine	4,686	240	2,420	299	0	580	0	235
	Total	17,904	4,256	19,176	43,900	7,627	22,286	24,718	40,575
30	Alaska I	15,781	9,251	15,035	21,491	10,708	12,215	7,133	7,099
	Alaska II					6,645	9,937	8,791	18,340
	Nass/Skeena	10,975	1,451	6,937	24,173	4,039	2,190	2,037	8,920
	Tahltan		1,626	0	0	0	114	254	0
	Stikine	7,990	65	416	1,305	64	215	0	212
	Total	34,746	12,393	22,388	46,969	21,456	24,671	18,215	34,571
31[c]	Alaska I	5,249	4,599	8,388	19,507	12,959	7,425	4,619	10,795
	Alaska II					12,345	11,844	6,975	8,233
	Nass/Skeena	6,573	3,227	6,654	30,943	7,553	3,729	448	9,488
	Tahltan		136	0	0	712	0	0	0
	Stikine	2,458	0	401	0	16	0	0	397
	Total	14,280	7,962	15,443	50,450	33,585	22,998	12,042	28,913
32	Alaska I		883	4,042	7,891	9,296	6,380	5,884	1,517
	Alaska II					7,806	12,690	5,462	5,551
	Nass/Skeena		357	1,631	5,602	7,612	3,958	998	3,423
	Tahltan		129	0	0	0	0	0	0
	Stikine		36	97	46	105	0	64	94
	Total		1,405	5,770	13,539	24,819	23,028	12,408	10,585
33	Alaska I		1,561	1,812	5,287	5,397	3,662	2,355	2,011
	Alaska II					4,162	2,148	1,284	4,098
	Nass/Skeena		762	1,080	7,259	10,182	1,206	1,950	5,578
	Tahltan		133	0	0	121	0	0	0
	Stikine		74	120	182	0	102	0	119
	Total		2,530	3,012	12,728	19,862	7,118	5,589	11,806
34	Alaska I		790	1,382	3,560	3,293			
	Alaska II					2,425			
	Nass/Skeena		143	820	5,249	8,970			
	Tahltan		51	0	0	0			
	Stikine		2	80	247	1			
	Total		986	2,282	9,056	14,689			
35-40	Alaska I		595						
	Alaska II								
	Nass/Skeena		274						
	Tahltan		30						
	Stikine		16						
	Total		915						
Season Totals	Alaska I	94,187	32,671	60,367	126,952	65,139	66,504	45,471	49,657
	Alaska II					35,195	46,389	35,397	76,947
	Nass/Skeena	61,796	10,611	24,661	111,051	42,684	21,190	9,784	59,958
	Tahltan		5,030	2,677	24,050	2,081	1,376	1,813	1,111
	Stikine	37,635	632	4,084	3,014	606	968	64	5,061
	Total	193,618	48,944	91,789	265,067	145,705	136,427	92,529	192,734

[a] The Alaska I and Alaska II groups were combined prior to 1986.
[b] Tahltan and Stikine (non-Tahltan) were not separated in the 1982 analysis.
[c] The last figures in each column include catch from that week through the end of the season.

Appendix D.2. Estimated contribution rates of sockeye salmon stock groups to Alaskan District 106 gillnet fisheries, 1982-1989. Subdistrict 106-30 was open but 106-41 was not during weeks 25-28 in 1984, week 26 in 1985, and week 19 in 1986.

		Year and Date of Statistical Week 25 (June)							
Stat. Week	Stock Group	1982 13-19	1983 12-18	1984 17-23	1985 16-22	1986 15-21	1987 14-20	1988 12-18	1989 18-24
25[a]	Alaska I	0.577	not	0.809	0.760	0.854	not	not	0.245
	Alaska II		open			0.010	open	open	0.276
	Nass/Skeena	0.405		0.119	0.121	0.136			0.394
	Tahltan	[b]		0.066	0.118	0.000			0.030
	Stikine	0.018		0.005	0.000	0.000			0.055
26	Alaska I	0.504	0.589	0.723	0.675	0.831	0.718	0.810	0.387
	Alaska II					0.016	0.181	0.093	0.152
	Nass/Skeena	0.319	0.296	0.152	0.175	0.136	0.063	0.033	0.303
	Tahltan		0.095	0.076	0.133	0.017	0.036	0.064	0.068
	Stikine	0.177	0.019	0.049	0.017	0.000	0.003	0.000	0.090
27	Alaska I	0.575	0.572	0.710	0.504	0.697	0.665	0.742	0.284
	Alaska II					0.035	0.196	0.130	0.244
	Nass/Skeena	0.293	0.233	0.140	0.211	0.175	0.130	0.071	0.315
	Tahltan		0.188	0.109	0.275	0.068	0.010	0.057	0.022
	Stikine	0.131	0.007	0.040	0.010	0.024	0.000	0.000	0.136
28	Alaska I	0.409	0.722	0.648	0.470	not	0.509	0.672	0.164
	Alaska II					open	0.173	0.182	0.405
	Nass/Skeena	0.326	0.150	0.241	0.349		0.278	0.113	0.391
	Tahltan		0.121	0.107	0.167		0.038	0.034	0.003
	Stikine	0.265	0.007	0.005	0.013		0.003	0.000	0.037
29	Alaska I	0.509	0.801	0.694	0.479	0.798	0.702	0.463	0.338
	Alaska II					0.146	0.144	0.403	0.456
	Nass/Skeena	0.229	0.059	0.163	0.351	0.056	0.120	0.109	0.200
	Tahltan		0.083	0.016	0.163	0.000	0.009	0.025	0.000
	Stikine	0.262	0.056	0.126	0.007	0.000	0.026	0.000	0.006
30	Alaska I	0.454	0.746	0.672	0.458	0.499	0.495	0.392	0.205
	Alaska II					0.310	0.403	0.483	0.531
	Nass/Skeena	0.316	0.117	0.310	0.515	0.188	0.089	0.112	0.258
	Tahltan		0.131	0.000	0.000	0.000	0.005	0.014	0.000
	Stikine	0.230	0.005	0.019	0.028	0.003	0.009	0.000	0.006
31[c]	Alaska I	0.368	0.578	0.543	0.387	0.386	0.323	0.384	0.373
	Alaska II					0.368	0.515	0.579	0.285
	Nass/Skeena	0.460	0.405	0.431	0.613	0.225	0.162	0.037	0.328
	Tahltan	0.000	0.017	0.000	0.000	0.021	0.000	0.000	0.000
	Stikine	0.172	0.000	0.026	0.000	0.000	0.000	0.000	0.014
32	Alaska I		0.628	0.701	0.583	0.375	0.277	0.474	0.143
	Alaska II					0.315	0.551	0.440	0.524
	Nass/Skeena		0.254	0.283	0.414	0.307	0.172	0.080	0.323
	Tahltan		0.092	0.000	0.000	0.000	0.000	0.000	0.000
	Stikine		0.026	0.017	0.003	0.004	0.000	0.005	0.009
33	Alaska I		0.617	0.602	0.415	0.272	0.514	0.421	0.170
	Alaska II					0.210	0.302	0.230	0.347
	Nass/Skeena		0.301	0.359	0.570	0.513	0.169	0.349	0.472
	Tahltan		0.053	0.000	0.000	0.006	0.000	0.000	0.000
	Stikine		0.029	0.040	0.014	0.000	0.014	0.000	0.010
34	Alaska I		0.801	0.606	0.393	0.224			
	Alaska II					0.165			
	Nass/Skeena		0.145	0.359	0.580	0.611			
	Tahltan		0.052	0.000	0.000	0.000			
	Stikine		0.002	0.035	0.027	0.000			
35-40	Alaska I		0.650						
	Alaska II								
	Nass/Skeena		0.299						
	Tahltan		0.033						
	Stikine		0.017						
Season Totals	Alaska I	0.486	0.668	0.658	0.479	0.447	0.487	0.491	0.258
	Alaska II					0.242	0.340	0.383	0.399
	Nass/Skeena	0.319	0.217	0.269	0.419	0.293	0.155	0.106	0.311
	Tahltan	0.000	0.103	0.029	0.091	0.014	0.010	0.020	0.006
	Stikine	0.194	0.013	0.044	0.011	0.004	0.007	0.001	0.026

[a] The Alaska I and Alaska II groups were combined prior to 1986.
[b] Tahltan and Stikine (non-Tahltan) were not separated in the 1982 analysis.
[c] The last figures in each column include catch from that week through the end of the season.

Appendix D.3. Estimated contributions of sockeye salmon stock groups to Alaskan Subdistrict 106-30 and 106-41&42 gillnet fisheries, 1985-1989.

		106-30 Year and Date					106-41 Year and Date				
Stat. Week	Group	1985 16-22	1986 15-21	1987 14-20	1988 12-18	1989 18-24	1985 16-22	1986 15-21	1987 14-20	1988 12-18	1989 18-24
25[a]	Alaska I	1,821	553	not	not	603	7,458	1,659	not	not	925
	Alaska II		27	open	open	175		0	open	open	1,544
	Nass/Skeena	285	64			344	1,192	287			2,114
	Tahltan	451	0			27	993	0			163
	Stikine	3	0			39	0	0			303
	Total	2,560	644			1,188	9,643	1,946			5,049
26	Alaska I	6,909	537	809	430	756	not	2,527	2,886	1,394	2,623
	Alaska II		46	312	108	386	open	14	619	102	943
	Nass/Skeena	1,789	59	33	21	545		444	289	53	2,098
	Tahltan	1,365	0	135	1	0		62	51	144	592
	Stikine	170	0	14	0	87		0	0	0	697
	Total	10,233	642	1,303	560	1,774		3,047	3,845	1,693	6,953
27	Alaska I	4,879	3,539	1,511	2,258	649	9,435	8,585	5,422	4,061	2,159
	Alaska II		74	1,046	347	914		536	996	761	1,503
	Nass/Skeena	2,099	673	358	78	766	3,904	2,377	996	523	2,351
	Tahltan	558	9	4	77	13	7,243	1,175	100	411	202
	Stikine	0	0	0	0	158	270	420	0	0	1,187
	Total	7,536	4,295	2,919	2,760	2,500	20,852	13,093	7,514	5,756	7,402
28	Alaska I	5,985	not	4,108	2,003	3,969	11,704	not	6,445	3,899	2,842
	Alaska II		open	637	694	5,934		open	2,951	907	10,826
	Nass/Skeena	5,165		805	212	7,127	7,967		4,962	777	9,073
	Tahltan	19		6	0	114	6,269		774	296	0
	Stikine	361		14	0	449	131		43	0	1,084
	Total	11,530		5,570	2,909	17,593	26,071		15,175	5,879	23,825
29	Alaska I	3,642	6,086	5,714	3,913	2,437	17,383	not	9,927	7,522	11,272
	Alaska II		1,115	1,120	4,107	13,160		open	2,089	5,859	5,340
	Nass/Skeena	4,067	424	1,035	1,309	4,173	11,357		1,629	1,378	3,958
	Tahltan	2,856	2	76	467	0	4,296		116	163	0
	Stikine	17	0	580	0	130	282		0	0	105
	Total	10,582	7,627	8,525	9,796	19,900	33,318		13,761	14,922	20,675
30	Alaska I	7,544	5,400	5,007	3,113	3,754	13,947	5,308	7,208	4,020	3,345
	Alaska II		2,092	4,486	3,931	9,288		4,553	5,451	4,860	9,052
	Nass/Skeena	11,215	1,295	1,147	634	5,559	12,958	2,744	1,043	1,403	3,361
	Tahltan	0	0	0	197	0	0	0	114	57	0
	Stikine	502	0	0	0	151	803	64	215	0	61
	Total	19,261	8,787	10,640	7,875	18,752	27,708	12,669	14,031	10,340	15,819
31	Alaska I	6,349	5,590	3,007	1,330	1,642	13,158	7,369	4,418	3,289	9,153
	Alaska II		5,756	7,276	1,789	5,226		6,589	4,568	5,186	3,007
	Nass/Skeena	10,626	2,993	2,483	33	3,981	20,317	4,560	1,246	415	5,507
	Tahltan	0	0	0	0	0	0	712	0	0	0
	Stikine	0	0	0	0	125	0	16	0	0	272
	Total	16,975	14,339	12,766	3,152	10,974	33,475	19,246	10,232	8,890	17,939
32	Alaska I	2,730	3,659	3,074	2,161	942	5,161	5,637	3,306	3,723	575
	Alaska II		3,350	7,196	2,868	3,478		4,456	5,494	2,594	2,073
	Nass/Skeena	1,109	2,931	1,683	375	2,098	4,493	4,681	2,275	623	1,325
	Tahltan	0	0	0	0	0	0	0	0	0	0
	Stikine	46	105	0	0	49	0	0	0	64	45
	Total	3,885	10,045	11,953	5,404	6,567	9,654	14,774	11,075	7,004	4,018
33[b]	Alaska I	2,640	2,042	1,858	1,363	1,004	2,647	3,355	1,804	992	1,007
	Alaska II		1,058	1,150	677	1,849		3,104	998	607	2,249
	Nass/Skeena	2,582	2,696	476	696	2,704	4,677	7,486	730	1,254	2,874
	Tahltan	0	0	0	0	0	0	121	0	0	0
	Stikine	72	0	102	0	43	110	0	0	0	76
	Total	5,294	5,796	3,586	2,736	5,600	7,434	14,066	3,532	2,853	6,206
34	Alaska I	1,890	1,732				1,207	1,095			
	Alaska II		1,219					926			
	Nass/Skeena	3,152	5,336				1,550	2,906			
	Tahltan	0	0				0	0			
	Stikine	81	0				115	0			
	Total	5,123	8,287				2,872	4,927			
35-40	Alaska I						463	466			
	Alaska II							280			
	Nass/Skeena						547	728			
	Tahltan						0	0			
	Stikine						51	1			
	Total						1,061	1,475			
Season Totals	Alaska I	44,389	29,138	25,088	16,571	15,756	82,563	36,001	41,416	28,900	33,901
	Alaska II		14,737	23,223	14,521	40,410		20,458	23,166	20,876	36,537
	Nass/Skeena	42,089	16,471	8,020	3,358	27,297	68,962	26,213	13,170	6,426	32,661
	Tahltan	5,249	11	221	742	154	18,801	2,070	1,155	1,071	957
	Stikine	1,252	105	710	0	1,231	1,762	501	258	64	3,830
	Total	92,979	60,462	57,262	35,192	84,848	172,088	85,243	79,165	57,337	107,886

[a] The Alaska I and Alaska II stocks were combined in 1985.
[b] The last figures in each column include catch from that week through the end of the season.

Appendix D.4. Estimated contribution rates of sockeye salmon stock groups to Alaskan Subdistrict 106-30 and 106-41&42 gillnet fisheries, 1985-1989.

		106-30 Year and Date					106-41 Year and Date				
Stat. Week	Group	1985 16-22	1986 15-21	1987 14-20	1988 12-18	1989 18-24	1985 16-22	1986 15-21	1987 14-20	1988 12-18	1989 18-24
25[a]	Alaska I	0.711	0.859	not	not	0.508	0.773	0.853	not	not	0.183
	Alaska II		0.042	open	open	0.147		0.000	open	open	0.306
	Nass/Skeena	0.111	0.099			0.290	0.124	0.147			0.419
	Tahltan	0.176	0.000			0.023	0.103	0.000			0.032
	Stikine	0.001	0.000			0.033	0.000	0.000			0.060
26	Alaska I	0.675	0.836	0.621	0.768	0.426	not	0.829	0.751	0.823	0.377
	Alaska II		0.072	0.239	0.193	0.218	open	0.005	0.161	0.060	0.136
	Nass/Skeena	0.175	0.092	0.025	0.038	0.307		0.146	0.075	0.031	0.302
	Tahltan	0.133	0.000	0.104	0.002	0.000		0.020	0.013	0.085	0.085
	Stikine	0.017	0.000	0.011	0.000	0.049		0.000	0.000	0.000	0.100
27	Alaska I	0.647	0.824	0.518	0.818	0.260	0.452	0.656	0.722	0.706	0.292
	Alaska II		0.017	0.358	0.126	0.366		0.041	0.133	0.132	0.203
	Nass/Skeena	0.279	0.157	0.123	0.028	0.306	0.187	0.182	0.133	0.091	0.318
	Tahltan	0.074	0.002	0.001	0.028	0.005	0.347	0.090	0.013	0.071	0.027
	Stikine	0.000	0.000	0.000	0.000	0.063	0.013	0.032	0.000	0.000	0.160
28	Alaska I	0.519	not	0.738	0.689	0.226	0.449	not	0.425	0.663	0.119
	Alaska II		open	0.114	0.239	0.337		open	0.194	0.154	0.454
	Nass/Skeena	0.448		0.145	0.073	0.405	0.306		0.327	0.132	0.381
	Tahltan	0.002		0.001	0.000	0.006	0.240		0.051	0.050	0.000
	Stikine	0.031		0.003	0.000	0.026	0.005		0.003	0.000	0.045
29	Alaska I	0.344	0.798	0.670	0.399	0.122	0.522	not	0.721	0.504	0.545
	Alaska II		0.146	0.131	0.419	0.661		open	0.152	0.393	0.258
	Nass/Skeena	0.384	0.056	0.121	0.134	0.210	0.341		0.118	0.092	0.191
	Tahltan	0.270	0.000	0.009	0.048	0.000	0.129		0.008	0.011	0.000
	Stikine	0.002	0.000	0.068	0.000	0.007	0.008		0.000	0.000	0.005
30	Alaska I	0.392	0.615	0.471	0.395	0.200	0.503	0.419	0.514	0.389	0.211
	Alaska II		0.238	0.422	0.499	0.495		0.359	0.388	0.470	0.572
	Nass/Skeena	0.582	0.147	0.108	0.081	0.296	0.468	0.217	0.074	0.136	0.212
	Tahltan	0.000	0.000	0.000	0.025	0.000	0.000	0.000	0.008	0.006	0.000
	Stikine	0.026	0.000	0.000	0.000	0.008	0.029	0.005	0.015	0.000	0.004
	Alaska I	0.374	0.390	0.236	0.422	0.150	0.393	0.383	0.432	0.370	0.510
31	Alaska II		0.401	0.570	0.568	0.476		0.342	0.446	0.583	0.168
	Nass/Skeena	0.626	0.209	0.195	0.010	0.363	0.607	0.237	0.122	0.047	0.307
	Tahltan	0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.000	0.000	0.000
	Stikine	0.000	0.000	0.000	0.000	0.011	0.000	0.001	0.000	0.000	0.015
	Alaska I	0.703	0.364	0.257	0.400	0.143	0.535	0.382	0.299	0.532	0.143
32	Alaska II		0.333	0.602	0.531	0.530		0.302	0.496	0.370	0.516
	Nass/Skeena	0.285	0.292	0.141	0.069	0.319	0.465	0.317	0.205	0.089	0.330
	Tahltan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Stikine	0.012	0.010	0.000	0.000	0.007	0.000	0.000	0.000	0.009	0.011
33	Alaska I	0.499	0.352	0.518	0.498	0.179	0.356	0.239	0.511	0.348	0.162
	Alaska II		0.183	0.321	0.247	0.330		0.221	0.283	0.213	0.362
	Nass/Skeena	0.488	0.465	0.133	0.254	0.483	0.629	0.532	0.207	0.440	0.463
	Tahltan	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.000	0.000	0.000
	Stikine	0.014	0.000	0.028	0.000	0.008	0.015	0.000	0.000	0.000	0.012
34[b]	Alaska I	0.369	0.209				0.420	0.222			
	Alaska II		0.147					0.188			
	Nass/Skeena	0.615	0.644				0.540	0.590			
	Tahltan	0.000	0.000				0.000	0.000			
	Stikine	0.016	0.000				0.040	0.000			
35-40	Alaska I						0.436	0.316			
	Alaska II							0.190			
	Nass/Skeena						0.516	0.494			
	Tahltan						0.000	0.000			
	Stikine						0.048	0.001			
Season Totals	Alaska I	0.477	0.482	0.438	0.471	0.186	0.480	0.422	0.523	0.504	0.314
	Alaska II		0.244	0.406	0.413	0.476		0.240	0.293	0.364	0.339
	Nass/Skeena	0.453	0.272	0.140	0.095	0.322	0.401	0.308	0.166	0.112	0.303
	Tahltan	0.056	0.000	0.004	0.021	0.002	0.109	0.024	0.015	0.019	0.009
	Stikine	0.013	0.002	0.012	0.000	0.015	0.010	0.006	0.003	0.001	0.036

[a] The Alaska I and Alaska II stocks were combined in 1985.
[b] The last figures in each column include catch from that week through the end of the season.

Appendix D.5. Estimated contributions of sockeye salmon stock groups to Alaskan District 108 gillnet fisheries, 1986-1989.

Stat. Week	Stock Group	Catch 1986	Catch 1987	Catch 1988	Catch 1989	Proportions 1986	Proportions 1987	Proportions 1988	Proportions 1989
25	Alaska I	2			Catch	0.067			Catch
	Alaska II	4			Comb.	0.133			Comb.
	Nass/Skeena	1			With	0.033			With
	Tahltan	5			Week	0.167			Week
	Stikine	18			26	0.600			26
	Total	30							
26	Alaska I	1		44	46	0.071		0.080	0.103
	Alaska II	2		70	30	0.143		0.128	0.067
	Nass/Skeena	0		25	97	0.000		0.046	0.217
	Tahltan	3		121	110	0.214		0.221	0.246
	Stikine	8		288	164	0.571		0.526	0.367
	All Stikine River		160[a]				0.849[a]		
	Non Stikine River		29				0.153		
	Total	14	189	548	447				
27	Alaska I			Catch	Not			Catch	Not
	Alaska II			Comb.	Open			Comb.	Open
	Nass/Skeena			With				With	
	Tahltan			Week				Week	
	Stikine			26				26	
	All Stikine River		219				0.894		
	Non Stikine River		26				0.106		
	Total		245						
28	Alaska I			84	164			0.120	0.038
	Alaska II			67	395			0.096	0.090
	Nass/Skeena			23	243			0.033	0.056
	Tahltan			101	177			0.145	0.040
	Stikine			423	3,394			0.606	0.776
	All Stikine River		684				0.901		
	Non Stikine River		75				0.099		
	Total		759	698	4,373				
29	Alaska I		37	Catch	91		0.087	Catch	0.026
	Alaska II		14	Comb.	178		0.033	Comb.	0.050
	Nass/Skeena		0	With	105		0.000	With	0.030
	Tahltan		126	Week	34		0.298	Week	0.010
	Stikine		122	28	3,133		0.288	28	0.885
	Unknown		124[b]				0.293[b]		
	Total		423		3,541				
30	Alaska I	130			50	0.065			0.029
	Alaska II	298			229	0.148			0.133
	Nass/Skeena	47			99	0.023			0.057
	Tahltan	346			19	0.172			0.011
	Stikine	1188			1,325	0.591			0.769
	Total	2009			1,722				
31	Alaska I	20				0.029			
	Alaska II	65				0.095			
	Nass/Skeena	5				0.007			
	Tahltan	38				0.056			
	Stikine	555				0.813			
	Total	683							
32	Alaska I	13				0.016			
	Alaska II	173				0.219			
	Nass/Skeena	9				0.012			
	Tahltan	0				0.000			
	Stikine	593				0.753			
	Unknown		4[b]				1.000[b]		
	Total	788	4						
33	Alaska I	7				0.016			
	Alaska II	99				0.220			
	Nass/Skeena	5				0.011			
	Tahltan	0				0.000			
	Stikine	340				0.754			
	Total	451							
34-39	Alaska I	3				0.014			
	Alaska II	46				0.217			
	Nass/Skeena	3				0.014			
	Tahltan	0				0.000			
	Stikine	160				0.755			
	Total	212							
Season Totals	Alaska I	176	37	128	351	0.050	0.023	0.103	0.035
	Alaska II	687	14	137	832	0.197	0.009	0.110	0.083
	Nass/Skeena	70	0	48	544	0.020	0.000	0.039	0.054
	Tahltan	392	126	222	340	0.112	0.078	0.178	0.034
	Stikine	2862	122	711	8016	0.819	0.075	0.571	0.795
	All Stikine River		1063				0.656		
	Unknown		258				0.159		
	Total	3494	1620	1,246	10083				

[a] 1987 catch in weeks 26-28 estimated for total Stikine River fish (Tahltan and non-Tahltan Stikine) by averaging the weekly proportions of Stikine River fish in the commercial and test fishery catches in 1985 and 1986.

[b] The unknown group is comprised of age classes not digitized in week 29 and fish not sampled in weeks 34-39 in 1987.

Appendix E.1. Differences between inseason and postseason stock composition estimates for the Alaskan District 106 and 108 sockeye harvests, 1989.

Week and Date	Stock Group	Subdistrict 106-30			Subdistrict 106-41			District 108		
		In	Post	Change	In	Post	Change	In	Post	Change
6/18-6/24 Week 25	Alaska I	100.0	50.7	49.3	81.8	18.3	63.5	Weeks 25 and 26 were combined		
	Alaska II	0.0	14.7	-14.7	8.3	30.6	-22.3			
	Nass/Skeena	0.0	29.0	-29.0	1.7	41.9	-40.2			
	Tahltan	0.0	2.3	-2.3	0.0	3.2	-3.2			
	Stikine	0.0	3.3	-3.3	9.0	6.0	3.0			
6/25-7/01 Week 26	Alaska I	100.0	42.6	57.4	83.0	37.7	45.3	54.1	10.3	43.8
	Alaska II	0.0	21.8	-21.8	9.9	13.6	-3.7	14.6	6.7	7.9
	Nass/Skeena	0.0	30.7	-30.7	2.0	30.2	-28.2	16.7	21.7	-5.0
	Tahltan	0.0	0.0	0.0	0.0	8.5	-8.5	0.0	24.6	-24.6
	Stikine	0.0	4.9	-4.9	5.1	10.0	-4.9	14.6	36.7	-22.1
7/02-7/08 Week 27	Alaska I	75.9	26.0	49.9	76.2	29.2	47.0	Fishery not open		
	Alaska II	0.0	36.6	-36.6	0.0	20.3	-20.3			
	Nass/Skeena	0.0	30.6	-30.6	5.4	31.8	-26.4			
	Tahltan	0.0	0.5	-0.5	0.0	2.7	-2.7			
	Stikine	24.1	6.3	17.8	18.4	16.0	2.4			
7/09-7/15 Week 28	Alaska I	67.9	22.6	45.3	63.8	11.9	51.9	9.6	3.8	5.8
	Alaska II	15.2	33.7	-18.5	7.7	45.5	-37.8	30.0	9.0	21.0
	Nass/Skeena	4.7	40.5	-35.8	5.0	38.1	-33.1	0.0	5.6	-5.6
	Tahltan	0.0	0.6	-0.6	0.0	0.0	0.0	0.0	4.0	-4.0
	Stikine	12.2	2.6	9.6	23.5	4.5	19.0	60.4	77.6	-17.2
7/16-7/22 Week 29	Alaska I	79.5	12.2	67.3	85.7	54.6	31.1	0.0	2.6	-2.6
	Alaska II	3.2	66.1	-62.9	14.3	25.8	-11.5	44.4	5.0	39.4
	Nass/Skeena	0.0	21.0	-21.0	0.0	19.1	-19.1	0.0	3.0	-3.0
	Tahltan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	-1.0
	Stikine	17.3	0.7	16.6	0.0	0.5	-0.5	55.6	88.4	-32.8
7/23-7/29 Week 30	Alaska I	70.0	20.0	50.0	74.3	21.1	53.2	9.3	2.9	6.4
	Alaska II	30.0	49.6	-19.6	25.7	57.3	-31.6	42.4	13.3	29.1
	Nass/Skeena	0.0	29.6	-29.6	0.0	21.2	-21.2	0.0	5.7	-5.7
	Tahltan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	-1.1
	Stikine	0.0	0.8	-0.8	0.0	0.4	-0.4	48.3	77.0	-28.7
7/30-8/05 Week 31	Alaska I				79.6	51.0	28.6			
	Alaska II				16.6	16.8	-0.2			
	Nass/Skeena				3.8	30.7	-26.9			
	Tahltan				0.0	0.0	0.0			
	Stikine				0.0	1.5	-1.5			
	Alaska I	82.2	30.4	51.8	77.4	28.7	48.6	19.6	5.1	14.5
	Alaska II	8.1	35.5	-27.4	11.0	31.9	-20.9	32.1	8.6	23.6
Totals	Nass/Skeena	0.8	30.3	-29.5	2.3	30.5	-28.2	4.7	9.5	-4.8
	Tahltan	0.0	0.6	-0.6	0.0	2.4	-2.4	0.0	8.3	-8.3
	Stikine	8.9	3.3	5.7	9.3	6.4	2.9	43.6	68.6	-25.0

Appendix E.2. Log-likelihood (G) values for a comparison of weekly inseason and postseason stock composition estimates for the Alaskan Subdistrict 106-30 drift gillnet sockeye harvest, 1989. One was added to each estimate to avoid calculation of the logarithm of zero.

		Stock Group						
Date and Week	Estimate	Alaska I	Alaska II	Nass/ Skeena	Tahltan	Stikine	Total	G
6/18-6/24	Inseason	101	1	1	1	1	105	
Week 25	Postseason	103	31	60	6	8	207	
	Total	204	32	61	7	9	312	84.307
6/25-7/01	Inseason	101	1	1	1	1	105	
Week 26	Postseason	84	43	61	1	11	199	
	Total	185	44	62	2	12	304	108.197
7/02-7/08	Inseason	77	1	1	1	25	105	
Week 27	Postseason	49	68	57	2	13	188	
	Total	125	69	58	3	38	293	142.653
7/09-7/15	Inseason	69	16	6	1	13	105	
Week 28	Postseason	37	55	65	2	5	164	
	Total	106	71	71	3	18	269	81.585
7/16-7/22	Inseason	81	4	1	1	18	105	
Week 29	Postseason	19	101	33	1	2	156	
	Total	100	105	34	2	20	261	192.994
7/23-7/29	Inseason	71	31	1	1	1	105	
Week 30	Postseason	34	82	49	1	2	168	
	Total	105	113	50	2	3	273	83.134
	Inseason	494	49	6	1	55	605	
Totals	Postseason	321	374	319	8	35	1057	
	Total	815	424	325	9	90	1662	598.236

Appendix E.3. Log-likelihood (G) values for a comparison of weekly inseason and postseason stock composition estimates for the Alaskan Subdistrict 106-41 drift gillnet sockeye harvest, 1989. One was added to each estimate to avoid calculation of the logarithm of zero.

Date and Week	Estimate	Stock Group: Alaska I	Alaska II	Nass/ Skeena	Tahltan	Stikine	Total	G
6/18-6/24	Inseason	83	9	3	1	10	106	
Week 25	Postseason	32	53	73	6	11	176	
	Total	115	63	75	7	21	282	125.192
6/25-7/01	Inseason	84	11	3	1	6	105	
Week 26	Postseason	63	23	51	15	17	169	
	Total	147	34	54	16	24	274	63.955
7/02-7/08	Inseason	77	1	6	1	19	105	
Week 27	Postseason	54	38	59	6	30	188	
	Total	132	39	66	7	50	293	80.374
7/09-7/15	Inseason	65	9	6	1	25	105	
Week 28	Postseason	20	73	62	1	8	164	
	Total	85	82	68	2	33	269	131.975
7/16-7/22	Inseason	87	15	1	1	1	105	
Week 29	Postseason	88	42	32	1	2	165	
	Total	175	58	33	2	3	270	36.156
7/23-7/29	Inseason	75	27	1	1	1	105	
Week 30	Postseason	36	95	36	1	2	169	
	Total	111	122	37	2	3	274	82.019
7/30-8/05	Inseason	81	18	5	1	1	105	
Week 31	Postseason	92	31	56	1	4	184	
	Total	173	49	61	2	5	289	34.978
	Inseason	466	67	15	1	57	606	
Totals	Postseason	288	320	306	25	66	1006	
	Total	754	387	321	26	123	1612	474.426

Appendix E.4. Log-likelihood (G) values for a comparison of weekly inseason and postseason stock composition estimates for the Alaskan District 108 gillnet sockeye harvest, 1989. One was added to each estimate to avoid calculation of the logarithm of zero.

Date and Week	Estimate	Stock Group: Alaska I	Alaska II	Nass/ Skeena	Tahltan	Stikine	Total	G
6/18-7/01	Inseason	64	18	20	1	18	121	
Wks 25-26	Postseason	16	11	34	38	56	155	
	Total	80	29	54	39	74	276	95.746
7/02-7/08	Fishery Not Open							
7/09-7/15	Inseason	11	31	1	1	61	105	
Week 28	Postseason	6	13	9	6	107	141	
	Total	17	44	10	7	168	246	26.867
7/17-7/22	Inseason	1	45	1	1	57	105	
Week 29	Postseason	4	7	5	2	108	126	
	Total	5	52	6	3	165	231	50.770
7/23-7/29	Inseason	10	43	1	1	49	105	
Week 30	Postseason	5	19	9	3	108	144	
	Total	15	63	10	4	157	249	35.460
	Inseason	83	135	20	1	182	421	
Totals	Postseason	29	48	53	46	376	551	
	Total	111	183	73	47	558	972	191.642